SOIL SURVEY

Homer-Ninilchik Area Alaska

Issued July 1971

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
ALASKA AGRICULTURAL EXPERIMENT STATION

Major fieldwork for this soil survey was done in the period 1962–63. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1963. This survey was made cooperatively by the Soil Conservation Service and the Alaska Agricultural Experiment Station. It is part of the technical assistance furnished to the Homer Soil Conservation Subdistrict of Alaska and the Ninilchik Soil Conservation Subdistrict of Alaska.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All of the soils of the Homer-Ninilchik Area are shown on the detailed map at the back of this publication. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in this soil survey. This guide lists all of the soils of the survey area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the management group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussion of the management groups (capability units).

Foresters and others can refer to the section "Native Vegetation" where the vegetation in the Homer-Ninilchik Area is discussed by soil associations.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Engineers and builders will find, under "Engineering Uses of Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices and structures.

Scientists and others can read about how the soils were formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in the Homer-Ninilchik Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of the Area," which gives additional information about the survey area.

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BY ROBERT B. HINTON

SOILS SURVEYED BY ROBERT B. HINTON, JOHN W. Van DINE, AND BILLY C. WEISENBERGER, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH ALASKA AGRICULTURAL EXPERIMENT STATION

THE HOMER-NINILCHIK AREA, in the southwestern part of the Kenai Peninsula of south-central Alaska (fig. 1), has a total area of 271,700 acres. It is bounded on the west by Cook Inlet and on the south by Kachemak Bay, and it extends 5 to 12 miles inland from these tidal waters.

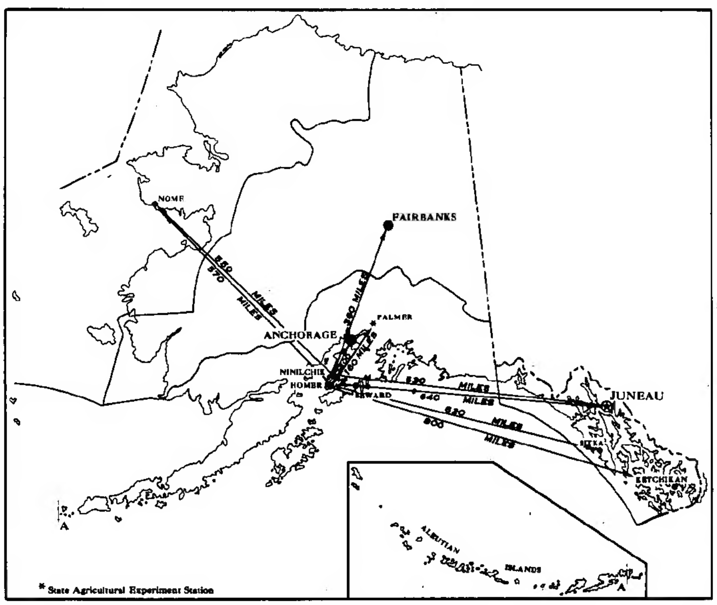

Figure 1.—**Location of the Homer-Ninilchik Area in Alaska.**

Included in this survey area are the southern part of the Caribou Hills, the slopes between the Caribou Hills and Kachemak Bay, and the plains, terraces, and moraines of the Kenai Lowlands. Within the survey area elevations range from 800 to 1,900 feet in the Caribou Hills but are less than 600 feet in most other areas. Soils that are suited to cultivated crops occur throughout the survey area, but at elevations of more than 1,200 feet grazing is a better use.

Most of the Homer-Ninilchik Area that is at an elevation of no more than 800 feet is woodland. The Caribou Hills are covered mainly by grasses, though spruce grows in large and small clumps on the grassland. Thickets of alder are common at elevations of more than 1,400 feet. A more detailed description of the vegetation in the survey area is given in the section "Native Vegetation."

General Nature of the Area

This section provides general information about the Homer-Ninilchik Area. It discusses geology, climate, and the settlement and development of the survey area.

Geology

The Homer-Ninilchik Area is underlain by the Kenai formation, a gently folded, fresh-water deposit several thousand feet thick. This deposit is of Eocene age. According to Barnes and Cobb *(3)*,[1] the Kenai formation consists of moderately indurated sand, silt, and clay that generally occur in thin, intergraded beds and lenses. These are interbedded with a few thin lenses of conglomerate material and many beds of subbituminous and lignitic coal that range from a few inches to 7 feet in thickness. Thin layers of volcanic ash are in several coal beds near the head of Kachemak Bay. Common throughout the Kenai formation, except in the area north of Ninilchik, are masses of ferruginous material in thick beds of sandstone and distinct bands and nodules of ironstone in all beds. These resistant masses of sandstone have accumulated as irregularly shaped boulders in some areas of beaches.

Glacial drift covers the Kenai formation in many parts of the survey area. The drift consists of coarse morainic material that contains many boulders and of thick deposits of gravelly outwash in the principal valleys. The morainic material apparently originated in the Kenai Mountains to the east. Glacial deposits are absent and beds of the Kenai formation occur near the surface of nearly level terrace remnants in the northern part of the survey area, and in all but the highest parts of the Caribou Hills. Colluvium from the Caribou Hills covers much of the area between Kachemak Bay and the bluffs at the edge of the hills. Homer Spit, which extends into Kachemak Bay for more than 4 miles, is a narrow bar consisting of coarse beach gravel and boulders *(5)*.

[1] Italic numbers in parentheses refer to Literature Cited, p. 46.

The principal streams in the survey area flow through deeply incised valleys that have nearly level bottoms. The valleys were probably cut when the streams that flowed through the survey area carried large amounts of melt water from glaciers to the east. The streams in the northern and western parts of the survey area do not carry glacial outwash material, but the Fox River and Sheep Creek, near the head of Kachemak Bay, are streams fed by glacial melt water, and they carry heavy loads of silt.

Uplands throughout the survey area are mantled by wind-deposited silty material that ranges from a few inches in thickness on some steep slopes to 60 inches in other places. This material probably is a mixture of loess that was derived from glacial material and ash from volcanoes in the Aleutian Range west of Cook Inlet. In the southern part of the survey area, including the Caribou Hills, the ash part of the mixture is dominant.

Climate [2]

The Homer-Ninilchik Area is influenced mainly by maritime climatic factors. Summers are cool, and winters are long and moderately cold. Early in summer, the weather is generally sunny and fairly dry, but late in summer and in fall, cloudy, rainy weather is dominant. A summary of temperature and precipitation data from two weather stations in the survey area is given in table 1. Also listed in the table are heating degree-days.

The waters of Cook Inlet and Kachemak Bay have a moderating effect on the climate in this survey area, and the Alaska Range protects it from the most severe outbreaks of cold air that flow from the interior. The Kenai Mountains to the east block the flow of moist air from the Gulf of Alaska.

Precipitation.—Precipitation is heavier in the southern part of the Homer-Ninilchik Area than in the northern part. It increases as elevation increases. Homer, in the extreme southern part of the survey area, receives about 24 inches of precipitation annually, and Homer 5NW, a weather station in the Caribou Hills at an elevation of 1,100 feet, receives about 28 inches. Ninilchik, in the northern part of the survey area, receives about 19 inches. Throughout the survey area precipitation is lightest late in winter and in spring, and it is heaviest late in summer and in fall.

The relatively light rainfall in the early part of the growing season generally is offset by the large amount of soil moisture that comes from melted snow. Critical droughts seldom occur in the survey area. The rainfall from late in June through the rest of the season generally is sufficient for crop growth. After late in July, frequent rains may delay the harvesting of hay.

The annual snowfall is about 49 inches at Homer and about 105 inches at the Homer 5NW station. This amount or more probably falls throughout the Caribou Hills. The amount of snow at Ninilchik probably is about the same as that at Kenai, where the average is 66 inches. About 5 to 24 inches of snow normally accumulates at Homer, but more accumulates in the Caribou Hills. A considerable amount of snow melts during the winter.

Temperature.—At Homer the moderating influence of the nearby ocean is reflected in the winter temperatures, which seldom remain below zero for more than a week. At Ninilchik, however, temperatures are more extreme and cold spells last longer. Summers are cool throughout the survey area. The temperature is occasionally in the high 60's for a week or more at a time. A temperature of 70° F. generally occurs in most years, but it ordinarily lasts for only 1 or 2 days. The highest temperature recorded in the survey area was 81° at the Homer 5NW station, and the lowest was -18° at Homer. Cold air from glaciers of the Kenai Mountains cross Kachemak Bay and affect the temperature at Homer, but the extreme high and low temperatures that are common farther north on the Kenai Peninsula do not occur at Homer.

The heating degree-days given in table 1 were computed by recording for each day the significant mean departure from a temperature base of 65° F. and by adding these departures for the month and for the year. The purpose of the computation is to determine positive or negative departures from a selected base temperature. The base of 65° is used because this is the lowest mean daily temperature at which no heat is required in homes. To determine the departure for 1 day, the actual mean temperature, if less than 65°, is subtracted from 65°. For example, a day with a mean temperature of 55° has a value of 10 heating degree-days. A day with a mean temperature of 65° or more, however, has no heating degree-days because no heat is required. Heating degree-days are useful in calculating the amount of fuel needed in an average year and in comparing a particular season with the average.

Table 2 gives the average dates of the beginning and end of the season during which the temperature is equal to or above specified freezing temperatures. During a period of 22 years, the average growing season at Homer was 107 days, and the range was from 82 to 157 days. The average frost-free period at Homer is from May 30 to September 15. In 14 years the growing season at the Homer 5NW station averaged 138 days and ranged from 109 to 169 days. The shorter periods at Homer are probably caused by drainage of cold air from the partly glaciated Kenai Range. During a 6-year period at Venta (elevation 150 feet), the average frost-free period was 115 days. Venta is in the Fox River area near the head of Kachemak Bay.

It should be emphasized that the season suitable for successful crop production does not necessarily equal the number of freeze-free days. Higher areas receive more than twice the amount of snowfall and have greater seasonal accumulation than Homer. In the spring a longer time is required for the snow to melt in the higher areas, and the soils are slower to warm and dry than at the lower elevations. Spring planting is delayed beyond the time when the soils at lower elevations are ready for tillage and planting.

Wind.—The Homer area is fairly well sheltered, for it is protected by the Kenai Range to the east and by

[2] By Clarence E. Watson, regional climatologist, Weather Bureau, ESSA, U.S. Department of Commerce, Anchorage, Alaska.

TABLE 1.—*Temperature and precipitation data for two weather stations in the Homer-Ninilchik Area, Alaska*

Homer [1] (elevation 67 feet)

Month	Temperature									Heating degree-days	Precipitation	
	Average [2]			Extremes		Number of days with [3]—						
						Maximum of—		Minimum of—				
	Daily maximum	Daily minimum	Monthly	Highest on record	Lowest on record	70° and above	32° and below	32° and below	0° and below	Base 65° F.	Mean total [4]	Mean total snowfall [5]
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.		Inches	Inches
January	29.1	15.6	22.4	50	—17	0	18	29	4	1,321	2.05	10.4
February	32.8	18.7	25.7	52	—18	0	11	25	3	1,100	1.44	8.4
March	35.4	20.3	27.8	50	—17	0	9	29	1	1,153	1.38	8.3
April	43.0	28.1	35.6	60	—9	0	1	23	4	882	1.30	2.7
May	50.4	34.7	42.6	68	6	0	([6])	10	0	694	1.07	.2
June	57.4	40.8	49.1	80	29	1	0	1	0	477	1.05	0
July	60.8	44.7	52.8	79	34	1	0	0	0	378	1.76	0
August	60.1	45.0	52.6	78	31	1	0	([6])	0	384	2.82	0
September	54.8	39.0	46.9	68	20	0	0	5	0	543	2.76	([7])
October	45.0	31.3	38.1	60	10	0	1	18	0	834	3.51	1.1
November	35.2	22.4	28.8	58	—6	0	11	26	([6])	1,086	2.70	6.9
December	28.9	16.3	22.6	48	—13	0	19	28	3	1,814	2.63	11.2
Total	44.4	29.7	37.1	....	....	3	70	194	15	10,166	24.47	49.2

Homer 5NW station (5 miles northwest of Homer [8]; elevation more than 1,100 feet)

Month	Daily maximum	Daily minimum	Monthly	Highest on record	Lowest on record	70° and above	32° and below	32° and below	0° and below	Base 65° F.	Mean total	Mean total snowfall
January	28.5	18.2	23.3	47	—8	0	18	30	2	1,293	1.85	16.3
February	30.5	18.3	24.4	50	—10	0	14	27	3	1,137	1.88	20.1
March	33.4	20.0	26.7	54	—9	0	13	30	1	1,187	1.34	12.4
April	39.8	27.7	33.7	58	7	0	3	25	0	939	1.46	9.4
May	47.3	35.8	41.6	66	25	0	0	4	0	725	1.27	.6
June	55.6	42.7	49.2	81	32	1	([6])	([6])	0	474	.98	([7])
July	58.7	46.5	52.6	78	38	2	0	0	0	384	2.78	0
August	58.0	46.9	52.5	75	36	([6])	([6])	0	0	388	3.14	0
September	51.8	41.1	46.5	62	24	0	0	2	0	555	3.32	.2
October	42.0	31.5	36.8	65	10	0	2	16	0	874	3.68	5.5
November	34.0	25.0	29.5	52	—2	0	10	25	([6])	1,065	3.65	15.8
December	26.8	17.5	22.2	46	—9	0	21	30	2	1,327	2.78	24.4
Total	42.2	30.9	36.6			3	81	189	8	10,348	28.13	104.7

[1] Data for period 1931-60.
[2] Based on 25 years of record for Homer and 9 years of record for Homer 5NW.
[3] Based on 18 years of record for Homer and 9 years of record for Homer 5NW.
[4] Based on 30 years of record for Homer and 9 years of record for Homer 5NW.
[5] Based on 23 years of record for Homer and 9 years of record for Homer 5NW.
[6] Less than one-half day.
[7] Trace.
[8] Data for period 1951-60.

the Aleutian Range across Cook Inlet to the west. But strong winds do occur. Although the prevailing winds are from the northeast, strong winds seldom blow from the east or north. Most of the strong winds that reach the survey area are channeled up Cook Inlet and are from the southwest or west-southwest. Strong winds from the southeast seldom occur. Wind data are not available for Ninilchik, but the data for Kenai probably apply to Ninilchik. Records at Kenai show that the direction of the prevailing wind is from the north or northeast from September through April and is from south or southeast from May through August. Winds generally are strongest in the fall and winter.

Settlement and Development

Russian explorers reported that in the mid-1700's the Athabascan Indians lived in villages near the present sites of Ninilchik and Homer. The first permanent white settlement in the survey area was established in 1830 at Ninilchik by employees retired from a fur-trading organization. These early settlers lived mostly by fishing, but they cleared patches of land for vegetables, potatoes, and a few other crops. They also raised poultry and a few dairy cattle.

Except for the Indians, the earliest residents of Homer were itinerant trappers, hunters, and fishermen. Commercial fishing became important in 1920

TABLE 2.—*Average dates for beginning and end of season during which temperature is equal to or above that specified*

Temperature	Homer (22 years of record)			Homer 5NW (14 years of record)		
	Beginning date	Ending date	Number of days between dates	Beginning date	Ending date	Number of days between dates
°F.						
32	May 30	September 15	108	May 14	September 29	138
28	May 8	September 26	141	April 28	October 9	164
24	April 8	October 10	168	April 22	October 16	177
20	April 12	October 26	197	April 19	October 27	191
16	April 1	November 8	221	April 13	November 9	220

when boats owned by canneries began fishing in Kachemak Bay.

In the 1930's about 165 homesteaders settled in the vicinity of Homer and Anchor Point, but only a few were successful. Only 27 farmers were in the survey area in 1940. Most of the homesteaders that remained earned their living by fishing, logging, trapping, working in canneries, and doing construction work.

Although farming expanded after World War II and following the construction of the Sterling Highway in 1951, progress was slight because suitable markets were lacking. Only 10 full-time farmers and 8 part-time farmers were in the survey area in 1955, but the number of acres in farms and the number of livestock on the farms increased *(4)*. A few farmers produced potatoes and poultry for local markets.

In 1960 commercial fishing and tourist trade were the main sources of income in the survey area. In that year, there were about 250 acres of cropland and about 3,000 acres used for grazing, 15 full-time farmers, and about 50 part-time farmers. The principal crops included potatoes, grasses, barley, oats, and garden vegetables. Poultry, dairy products, swine and beef were produced for sale.

Electric power is available in most of the Homer-Ninilchik Area. Homer is the largest town in the survey area. It has churches, schools, telephone and telegraph service, a hospital, and a weekly newspaper. A commercial airline connects Homer with Anchorage and Kodiak. The Alaska Ferry, which serves Anchorage, Kodiak, and Seward, makes scheduled stops at Homer, and ocean-going steamers make regular calls at the Homer Port. Smaller settlements are Anchor Point and Ninilchik.

The population of the Homer-Ninilchik Area was about 2,200 in 1960. These people lived in, and in the vicinity of Homer (about 1,700), Anchor Point (about 300), and Ninilchik (about 200).

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in the Homer-Ninilchik Area, where they are located, and how they can be used. The soil scientists went into the survey area knowing they likely would find many soils they had already seen and perhaps some they had not. As they traveled over the survey area they observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in nearby areas and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Beluga and Coal Creek, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ somewhat in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Beluga silt loam, gently sloping, is one of several phases within the Beluga series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing

boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. The undifferentiated soil group is one such kind of mapping unit shown on the soil map of the Homer-Ninilchik Area.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Anchor Point and Killey silt loams is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so wet that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Alluvial land and Tidal marsh are examples of two land types in the Homer-Ninilchik Area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated.

The soil scientists set up trial groups of soils on the basis of yield and practice tables and other data they have collected. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then they adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Homer-Ninilchick Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in the Homer-Ninilchik Area are discussed in the following pages.

1. Cohoe-Salamatof Association

Deep, nearly level to moderately sloping, well-drained silt loams that occur on uplands; and very poorly drained peat soils of muskegs

This association occupies broad plains of the uplands between Cook Inlet and the Caribou Hills. It extends from the Anchor River in the western part of the survey area to the northern boundary. The plains are broken by deep, flat-bottomed valleys. Narrow bands of low hills border much of Cook Inlet. The soils on uplands are generally nearly level to moderately sloping, but steep soils occupy strips that border the major stream valleys. Shallow depressions of various sizes occur on the plains.

This association occupies about 39 percent of the survey area. It is about 45 percent Cohoe soils, 35 percent Salamatof soils, and 20 percent minor soils.

The Cohoe soils are well drained and mainly nearly level to moderately sloping but are steep in some places. They formed in silty material that is underlain by sandy, silty, and clayey sediments or, in areas bordering large streams, by gravelly material deposited by the streams. The Salamatof soils are in the muskegs. They are deep, very poorly drained peats.

The minor soils in this association include the well-drained Island soils, the very poorly drained Doroshin soils, the somewhat poorly drained Spenard soils, and the somewhat poorly drained or poorly drained Anchor Point, Killey, Slikok, and Moose River soils.

Except in the steeper areas, the well-drained soils in this association are well suited to farming. The somewhat poorly drained and poorly drained soils need artificial drainage if they are farmed. The Salamatof soils are not suitable for farming. In several areas the Cohoe soils have been cleared and are used for grasses, potatoes, and home gardens. The native vegetation on the dominant Cohoe soils consists mainly of white spruce and paper birch.

2. Mutnala-Salamatof Association

Nearly level to steep, well-drained silt loams that are shallow over gravelly glacial till and occur on uplands; and very poorly drained peat soils of muskegs

This association occurs in the southern part of the survey area. It is in the coastal region between Anchor

Point and Homer, in the Anchor River Valley, and in areas bordering the upper part of Kachemak Bay.

This association occupies about 23 percent of the survey area. It is about 40 percent Mutnala soils, 25 percent Salamatof soils, and 35 percent minor soils.

The well-drained Mutnala soils were formed in shallow silty material over gravelly till. In many places they are surrounded by the very poorly drained Salamatof soils of the muskegs.

Among the minor soils are the Kachemak, Starichkof, Coal Creek, Anchor Point, Killey, Moose River, and Slikok soils.

In the coastal region, there is a complex pattern of Mutnala soils on low moraines and Salamatof soils in depressions. Many of the depressions contain small lakes.

The pattern of soils is somewhat different in the Anchor River Valley. The Mutnala soils are steep and occur on the lower side slopes of the valleys. The Salamatof soils are in backwater areas on the valley floor and on low terraces. The somewhat poorly drained Anchor Point and Killey soils occur on natural levees adjacent to the stream channels. These soils are subject to flooding in many areas and have only limited value for farming.

In the central part of the Anchor River Valley, and in the valleys of some tributary streams, side slopes are long and concave and the flood plains are narrow. The Mutnala soils and the well-drained, grass-covered Kachemak soils occupy the upper parts of slopes. The poorly drained Coal Creek soils occur on the lower parts of slopes, and the Salamatof soils are in long, narrow areas on the valley floor. Along some smaller tributaries, poorly drained, mucky Slikok soils are dominant. In the central part of the Anchor River Valley, few areas are suitable for farming other than grazing. In most places, the Mutnala and Kachemak soils are too steep and the other soils are too wet.

At the headwaters of the Anchor River and Beaver Creek broad muskegs surround low forested knolls. The Mutnala soils occupy these knolls and the slopes that border the muskegs. In this part of the association, which generally is at an elevation of more than 1,200 feet, the main soil of the muskegs is Starichkof peat rather than Salamatof peat. The Starichkof peat is just as wet as the Salamatof peat and has no more value for farming.

The Mutnala soils support a forest in which white and Sitka spruce are the dominant trees. Use for farming is limited in many places by steep slopes and the isolation of small areas by the surrounding muskegs. The Salamatof soils are not suitable for farming.

3. Kachemak Association

Nearly level to steep, well-drained silt loams that are shallow to moderately deep over shale and sandstone; on uplands

This association occurs on rolling to steep hills, steep walls of valleys, and gently sloping hilltops and benches in the Caribou Hills. It is at elevations that range from 800 to 2,000 feet. Here the native vegetation is tall grasses, dominantly bluejoint reedgrass, and forbs and shrubs. The grasses are more than 5 feet high, and grass tussocks are as much as 18 inches high in places. Except at the higher elevation, scattered groves of Sitka spruce are common.

This association occupies about 26 percent of the survey area. It is about 80 percent Kachemak soils and 20 percent minor soils.

The Kachemak soils are well drained and dark colored. They formed in silty material that is underlain by soft shale and sandstone and, in places, by gravelly glacial drift.

The minor soils in this association are the Anchor Point, Coal Creek, Killey, Mutnala, Salamatof, Slikok, and Starichkof soils.

The Kachemak soils locally are important for farming. Potatoes, garden crops, and hay crops have been successfully grown in many areas. The native grasses are suitable for grazing. Above an elevation of 1,200 feet the soils in this association are better suited to grazing than to cultivated crops.

4. Beluga Association

Nearly level to strongly sloping, poorly drained silt loams that are moderately deep and deep to stratified fine sandy loam to silty clay loam; on foot slopes

This association is in the extreme southern part of the survey area. It occurs on foot slopes between Kachemak Bay and the Caribou Hills. Many areas are covered with tall grasses mixed with fireweed, forbs, and shrubs. In some areas white spruce, paper birch, and quaking aspen grow in sparse stands.

This association occupies about 5 percent of the survey area. It is about 60 percent Beluga soils and 40 percent minor soils.

The Beluga soils are poorly drained and nearly level to strongly sloping. They developed in medium-textured and moderately fine textured colluvium.

Among the minor soils in this association are the Doroshin, Kachemak, Mutnala, Salamatof, and Spenard soils.

Locally, this association is important to farming. Artificial drainage is needed, but drained areas are used for gardens, hay crops, and pasture. Much of the settlement in Homer and its vicinity has been in this association.

5. Alluvial Land-Tidal Marsh Association

Nearly level, very poorly drained to excessively drained alluvial sand, silt, and clay; and very poorly drained soils on Tidal marsh

This association occurs only in the Fox River Valley. It extends from the head of Kachemak Bay northward to the boundary of the survey area. Flowing through this wide, flat-bottomed valley are the Fox River and Sheep Creek, two large glacier-fed streams.

This association occupies about 4 percent of the survey area. It is about 50 percent Alluvial land, 35 percent Tidal marsh, and 15 percent minor soils.

Alluvial land consists of sandy, silty, and clayey material that was deposited by Sheep Creek and the

Fox River. It is dissected by many sloughs and stream channels that change positions from year to year. Tidal marsh occupies areas near the mouth of the Fox River. It is flooded occasionally by high tides and by fresh-water streams. Tidal marsh consists mainly of fine-textured sediments.

The minor soils in this association are mainly the poorly drained Beluga soils. Long, narrow bands of the poorly drained Moose River soils, which are too small to be shown on the map, are on natural levees along the Fox River. Frequently flooded narrow strips of Tidal flats border Kachemak Bay. The Beluga soils lie on the slopes between the alluvial plain and the bluffs bordering the Caribou Hills. Streams flowing from these hills occasionally flood the Beluga soils. The flooded areas are commonly covered with shale and lignite fragments. White spruce, black spruce, paper birch, and quaking aspen are the main trees growing on the Beluga soils. Tall grasses, shrubs, horsetail, and other forbs grow in the many open areas.

The native vegetation on Alluvial land includes alders, low willows, tall grasses, horsetail, and a few cottonwood (balsam poplar) trees. Areas of Tidal marsh have a cover of sedges, horsetail, beach wild-rye, and other plants common in the coastal meadows.

In this association some areas of Alluvial land and Tidal marsh are suitable for pasture. Small areas of the Beluga soils are used for gardens and hay crops.

6. Rough Broken Land Association

Steep and very steep, eroded escarpments, sea cliffs, and canyon walls

This association is in the southeastern part of the survey area. It consists of escarpments that border the Caribou Hills, of cliffs along the coast, and of deep canyons through which creeks flow into Kachemak Bay.

This association occupies about 3 percent of the survey area. It is about 90 percent Rough broken land, and the remaining 10 percent is Kachemak and Mutnala soils.

This association has no potential for farming. All areas are eroded, and seams of coal are exposed in some places. Springs flow from the base of many of the escarpments. Many areas are covered by thickets of alder brush.

Descriptions of the Soils

This section describes the soil series and mapping units in the Homer-Ninilchik Area. The approximate acreage and proportionate extent of each mapping unit are given in table 3.

The procedure in this section is first to describe the soil series and then the mapping units in the series. Thus, to get full information on any one mapping unit, it is necessary to read the description of the unit and also the description of the soil series to which it belongs. The description of a soil series mentions features that apply to all the soils in the series. Differences among the soils of one series are pointed out in the descriptions of the individual soils or are indicated in the soil name. Unless otherwise stated, the descriptions of all mapping units in this section are for moist soils. As mentioned in the section "How This Survey was Made," not all mapping units are members of a soil series. For example, Alluvial land is a miscellaneous land type and does not belong to a soil series; nevertheless, it is listed in alphabetic order along with the series.

An essential part of each soil series is the description of the soil profile, the sequence of layers beginning at the surface and continuing downward to the depth beyond which roots of most plants do not penetrate. Each soil series contains a short description of a soil profile that has characteristics or ranges of characteristics within the ranges set for the series. Also given for the soil series is a much more detailed description of a profile typical for the series. Scientists, engineers, and others can use this detailed description in making highly technical interpretations.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the management group and, in parentheses, the capability unit in which the mapping unit has been placed. The page on which each management group, or capability unit is described can be found by referring to the "Guide to Mapping Units" at the back of this soil survey.

Many terms used in the soil descriptions and other sections of this survey are defined in the Glossary at the back of this soil survey and in the "Soil Survey Manual" *(11)*.

Alluvial Land

Alluvial land (Ad) occurs only in the Fox River Valley. This land type occupies the entire flood plains of Sheep Creek and the Fox River, and it is dissected by many sloughs and by stream channels that change positions from time to time. Alluvial land consists of sandy, silty, and clayey material that was deposited by Sheep Creek and the Fox River. It is very poorly drained to excessively drained.

Included with Alluvial land in mapping, on natural levees adjacent to the Fox River, are long, narrow bands of the Moose River soils.

The native vegetation is alders, willows, tall grasses, horsetail, and a few scattered cottonwoods. Management group 23 (VIIIw-1).

Anchor Point Series

The Anchor Point series consists of somewhat poorly drained, nearly level soils that occur on natural levees and flood plains along the lower courses of major streams and their tributaries. These soils are most extensive at elevations of less than 200 feet, but a few areas along drainageways have elevations of as much as 800 feet. The average annual air temperature ranges from 34° to 37°, and the mean annual precipitation from 20 to 28 inches. The vegetation is a sparse

TABLE 3.—*Approximate acreage and proportionate extent of soils*

Soil	Homer Soil Conservation Subdistrict		Ninilchik Soil Conservation Subdistrict		Total Homer-Ninilchik Area	
	Acres	*Percent*	*Acres*	*Percent*	*Acres*	*Percent*
Alluvial land	4,480	2.5			4,480	1.6
Anchor Point and Killey silt loams	4,480	2.5	2,020	2.3	6,500	2.4
Beluga silt loam, nearly level	810	.4			810	.3
Beluga silt loam, gently sloping	4,100	2.3			4,100	1.5
Beluga silt loam, moderately sloping	3,640	2.0	10	(1)	3,650	1.3
Beluga silt loam, strongly sloping	840	.5			840	.3
Bernice sandy loam, strongly sloping to steep	1,930	1.1	1,670	1.9	3,600	1.3
Coal Creek silt loam, nearly level	2,160	1.2	930	1.0	3,090	1.1
Coal Creek silt loam, gently sloping	4,060	2.2	750	.8	4,810	1.8
Coal Creek silt loam, moderately sloping	2,870	1.6			2,870	1.1
Coal Creek silt loam, strongly sloping	250	.1			250	.1
Cohoe silt loam, nearly level	3,800	2.1	12,900	14.3	16,700	6.1
Cohoe silt loam, gently sloping	3,590	2.0	16,250	18.1	19,840	7.3
Cohoe silt loam, moderately sloping	1,130	.6	5,420	6.0	6,550	2.4
Cohoe silt loam, strongly sloping	450	.2	3,350	3.7	3,800	1.4
Cohoe silt loam, moderately steep	150	.1	1,000	1.1	1,150	.4
Cohoe silt loam, steep			1,300	1.5	1,300	.5
Doroshin peat, nearly level	5,480	3.0	3,220	3.6	8,700	3.2
Doroshin peat, gently sloping	1,440	.8	870	1.0	2,310	.9
Doroshin peat, moderately sloping	460	.2	190	.2	650	.2
Gravelly beach	1,460	.8	580	.6	2,040	.8
Grewingk fine sandy loam, strongly sloping to steep	1,100	.6	930	1.0	2,030	.7
Island silt loam, nearly level	660	.4	1,520	1.7	2,180	.8
Island silt loam, gently sloping	330	.2	310	.3	640	.2
Island silt loam, moderately sloping	250	.1	180	.2	430	.2
Island silt loam, strongly sloping	120	.1	320	.4	440	.2
Island silt loam, moderately steep	60	(1)	350	.4	410	.2
Kachemak silt loam, nearly level	470	.3			470	.2
Kachemak silt loam, gently sloping	4,110	2.3	10	(1)	4,120	1.5
Kachemak silt loam, moderately sloping	15,476	8.5	200	.2	15,676	5.8
Kachemak silt loam, strongly sloping	14,357	7.9	550	.6	14,907	5.5
Kachemak silt loam, moderately steep	11,040	6.1	300	.3	11,340	4.2
Kachemak silt loam, steep	15,126	8.3	130	.2	15,256	5.6
Moose River silt loam			1,670	1.9	1,670	.6
Mutnala silt loam, nearly level	1,180	.6	20	(1)	1,200	.4
Mutnala silt loam, gently sloping	5,380	3.0	470	.5	5,850	2.2
Mutnala silt loam, moderately sloping	9,240	5.1	1,300	1.5	10,540	3.9
Mutnala silt loam, strongly sloping	11,250	6.2	1,310	1.5	12,560	4.6
Mutnala silt loam, moderately steep	3,280	1.8	740	.8	4,020	1.5
Mutnala silt loam, steep	3,170	1.7	100	.1	3,270	1.2
Nikolai silt loam			150	.2	150	.1
Rough broken land	6,760	3.7	560	.6	7,320	2.7
Salamatof peat	18,771	10.3	20,310	22.6	39,081	14.4
Slikok mucky silt loam, nearly level	1,040	.6	1,540	1.7	2,580	.9
Slikok mucky silt loam, gently sloping	1,020	.6	430	.5	1,450	.5
Spenard silt loam, nearly level	1,450	.8	2,870	3.2	4,320	1.6
Spenard silt loam, gently sloping	2,060	1.1	1,540	1.7	3,600	1.3
Spenard silt loam, moderately sloping	330	.2	20	(1)	350	.1
Starichkof peat, nearly level	2,020	1.1	150	.2	2,170	.8
Starichkof peat, gently sloping	450	.2	1,440	1.6	1,890	.7
Tidal flats	360	.2			360	.1
Tidal marsh	3,140	1.7	40	(1)	3,180	1.2
Water	160	.1	40	(1)	200	.1
Total	181,740	100.0	89,960	100.0	271,700	100.0

[1] Less than 0.1 percent.

forest of white spruce and cottonwood and an understory of willows, bluejoint reedgrass, forbs, and shrubs.

The Anchor Point soils have about 4 inches of partly decomposed litter over dark grayish-brown and grayish-brown to dark-brown silt loam about 2 to 8 inches thick. Below the silt loam, to a depth of 15 to 30 inches, is mottled gray and grayish-brown, stratified, silty and sandy material. This mottled material abruptly overlies a thick deposit of very gravelly sand.

The Anchor Point soils have low available water capacity. Permeability is moderate in the upper 12 inches and is moderate to rapid below. Roots penetrate to a depth of 20 to 36 inches.

Most of the acreage of these soils is used as recreational areas and wildlife habitat. A few small areas have been cleared and are used for crops or gardens.

The Anchor Point soils were mapped only in an undifferentiated soil group with the Killey soils. Map-

ping these soils separately would serve no useful purpose because the two kinds of soils are used and managed in a similar way.

Typical profile of Anchor Point silt loam, SW¼SW¼, sec. 11, T. 5 S., R. 15 W., Kenai Peninsula:

O1—4 inches to 0, black (5YR 2/1) mat of partly decomposed organic matter and an admixture of silty material; grains of volcanic ash near bottom of horizon; contains fragments of charcoal.

A1—0 to 4 inches, mixed dark grayish-brown (10YR 4/2) and dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; very friable; many roots; very strongly acid; abrupt, smooth boundary.

C1—4 to 9 inches, dark-gray (10YR 4/1) loamy very fine sand; common, medium, faint mottles of dark grayish brown (10YR 4/2); weak, fine, subangular blocky structure; very friable; many roots; strongly acid; abrupt, smooth boundary.

C2—9 to 12 inches, gray (5Y 5/1) fine sandy loam; common, medium, distinct mottles of dark brown (10YR 3/3); weak, very thin, platy structure; very friable; common roots; very strongly acid; abrupt, wavy boundary.

C3—12 to 27 inches, grayish-brown (10YR 5/2) silt loam; common, medium, distinct mottles of dark brown (7.5YR 3/2); weak, very thin, platy structure; very friable; contains discontinuous streaks of material like that in the C2 horizon; very strongly acid; abrupt, smooth boundary.

IIC4—27 to 31 inches, very dark grayish-brown (2.5Y 3/2) and olive-gray (5Y 4/2) very gravelly sandy loam; thin seam of mixed dark reddish-brown (5YR 3/2) and olive-gray (5Y 4/2) medium sand; massive; loose; no roots; all pebbles are rounded and coated with dark reddish brown; abrupt, smooth boundary.

IIC5—31 to 40 inches, dark reddish-brown (5YR 3/2) very gravelly sand; tightly packed in place, but loose if disturbed; no roots; all pebbles are rounded and less than 1 inch in diameter.

The O1 layer ranges from 1 to 5 inches in thickness. The A1 horizon is fine sand or fine sandy loam in some places. It ranges from 2 to 8 inches in thickness. The strata of silty and sandy material vary considerably in thickness, texture, and sequence.

The Anchor Point soils are associated with the Coal Creek soils on foot slopes and with the Moose River, Salamatof, and Slikok soils on the flood plains. They have very gravelly layers in the substratum, but the Coal Creek soils have a firm gravelly or stony silt loam substratum that has lenses of sand and silty clay loam. An organic layer is on the surface of the Anchor Point soils, whereas the Salamatof soils are deep peats. Anchor Point soils are dominantly silt loams, but the Moose River soils are dominantly sandy and have a gravelly substratum at a depth of more than 30 inches. In contrast to Anchor Point soils, the Slikok soils are mucky in the upper part of the profile.

Anchor Point and Killey silt loams (Ap).—These soils are nearly level. They are somewhat poorly drained, but the water table is moderately deep in a few areas on natural levees. Flooding is a hazard in spring. Runoff is very slow, and the hazard of water erosion is only slight. Fertility is low. Available moisture capacity is low in the Anchor Point soil and moderate in the Killey soil. Some areas consist only of the Anchor Point soil, other areas consist entirely of the Killey soils, and still other areas are made up of both soils.

Included with these soils in mapping, on flood plains along Deep Creek and the lower part of the Anchor River, are small areas consisting of former stream channels, very gravelly spots, and wet spots. Also included are patches of the Moose River soils and the Slikok soils. Other inclusions are patches of soils in which the very gravelly material is at a depth of more than 40 inches.

The soils in this mapping unit are used mainly as recreational areas and wildlife habitat. A few small areas are used for gardens and hay. These areas are mainly along the North Fork River, where flooding is not so likely as it is in other places. Suitable crops include hardy vegetables, potatoes, small grains, and grasses grown for hay and pasture. Management group 11 (IVw–1).

Beluga Series

This series consists of poorly drained, nearly level to strongly sloping soils that are moderately deep and deep to firm underlying material. These soils are extensive near Homer, and they also occur in the Fox River Valley and in a few small areas along streams in the southern part of the Caribou Hills. Beluga soils formed in medium-textured and moderately fine textured colluvium that was derived from soft shale and sandstone. The native vegetation is a sparse forest of Sitka spruce, black spruce, paper birch, alder and, in the many open areas, bluejoint reedgrass, fireweed, and horsetail. The elevation ranges from a few feet to about 500 feet above sea level. The mean annual precipitation is about 24 inches, and the average annual air temperature is about 37°F.

In uncultivated areas the Beluga soils have a mat of partly decomposed litter over a very dark grayish-brown silt loam surface layer about 2 inches thick. This layer is underlain by stratified layers of mottled dark grayish-brown and gray silt loam and fine sandy loam to a depth of 20 to 40 inches. Below this is silty clay loam.

The Beluga soils have moderate available water capacity in drained areas. Permeability is moderate in the upper part of the profile and is moderately slow below. Plant roots penetrate to a depth of 15 to 30 inches. Fertility is moderate to low.

These soils are used for cultivated crops, pasture, and residential sites.

Typical profile of Beluga silt loam, gently sloping, SE¼SE¼, sec. 17, T. 6 S., R. 13 W., Kenai Peninsula:

O1—5 inches to 0, dark reddish-brown (5YR 2/2) mat of partly decomposed straw and woody material; mycelia in lower part of horizon.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam and pockets of dark grayish brown (10YR 4/2) silt loam; moderate, fine, granular structure; very friable; common roots; streaks of burned organic matter near bottom of horizon; strongly acid; abrupt, wavy boundary.

C1—2 to 8 inches, dark grayish-brown (10YR 4/2) silt loam; common, medium, distinct mottles of dark yellowish brown (10YR 4/4); moderate, fine, granular structure; very friable; common roots; medium acid; abrupt, wavy boundary.

C2—8 to 13 inches, dark grayish-brown (10YR 4/2) fine sandy loam; common, coarse, distinct mottles of dark yellowish brown (10YR 4/4); weak, thin, platy structure; very friable; common roots; medium acid; abrupt, wavy boundary.

C3—13 to 21 inches, gray (5Y 5/1) silt loam; common, medium, distinct mottles of dark yellowish brown (10YR 4/4); weak, thin, platy structure that

breaks to weak, fine, angular blocky structure; friable; few roots; thin seams of fine sandy loam; medium acid; abrupt, wavy boundary.

C4—21 to 27 inches, greenish-gray (5GY 5/1) fine sandy loam; common, medium, distinct mottles of olive brown (2.5Y 4/4); weak, thin, platy structure; very friable; few roots; thin layer of gravelly silt loam and fragments of red shale; medium acid; abrupt, smooth boundary.

C5—27 to 42 inches, gray (5Y 5/1) silty clay loam; common, coarse, prominent mottles of yellowish brown (10YR 5/6) and dark red (2.5YR 3/6); massive; firm; dark-red, partly decomposed fragments of shale; few fine pores and vesicles; underlying material is layered fine sandy loam, silt loam, and shaly silt loam; medium acid.

The A1 horizon is mottled in some places and is absent in other places. The strata of firm silty clay loam vary considerably in thickness and sequence. Thin strata of sand and angular fragments of shale and lignite may occur at any depth. Depth to the firm underlying material ranges from 15 inches to more than 40 inches. The C horizon generally is distinctly mottled with dark brown, dark yellowish brown, and dark reddish brown.

The Beluga soils are associated mainly with the well-drained Kachemak soils in areas adjacent to high escarpments, the well-drained Mutnala soils on knolls of foot slopes, the somewhat poorly drained Spenard soils on muskeg borders, and the very poorly drained Salamatof soils in muskegs. Unlike the Kachemak and Mutnala soils, the Beluga soils are mottled and stratified. Beluga soils commonly are underlain by colluvium, but the Kachemak soils are underlain by sandstone and soft shale, and the Mutnala and Spenard soils are underlain by firm gravelly glacial till. An organic layer is on the surface of the Beluga soils, but the Salamatof soils are deep peats.

Beluga silt loam, nearly level (0 to 3 percent slopes) (BaA).—This soil is adjacent to drainageways and muskegs. The water table generally is at the surface or within a few inches of it but is lower in small areas next to the natural drainage channels or in slightly higher areas. The water table is also lower in a few areas as much as 100 acres in size in the Fox River Valley. Areas near the mouths of the canyons or adjacent to streams are subject to flooding. Most of these areas are in the Fox River Valley. Runoff is very slow and is ponded in some places. Erosion is not a hazard. This soil generally needs artificial drainage if it is used for farming, but drainage is difficult in many places. Interceptor ditches at least as deep as the firm underlying material are needed.

Included with this soil in mapping are small areas of Salamatof peat and small areas of Spenard silt loam, nearly level.

A part of the acreage of this soil is pastured, and a few areas are used for cultivated crops. The common crops are hardy vegetables, potatoes, and grasses grown for hay and pasture. The native vegetation consists mainly of bluejoint reedgrass, horsetail, alder, and black spruce. Management group 8 (IIIw–2).

Beluga silt loam, gently sloping (3 to 7 percent slopes) (BaB).—This soil occupies a few fairly large areas. It generally occurs in broad areas on fairly uniform slopes. This soil has the profile described as typical for the series. Runoff is slow, and erosion is only a slight hazard. Seepage from higher areas keeps this soil wet unless it is drained.

Included with this soil in mapping are small areas of steeper Beluga soils and spots of Mutnala and Salamatof soils.

Most of the acreage of this soil is covered by bluejoint reedgrass, fireweed, and a sparse forest of Sitka spruce and paper birch. A few areas have been drained and are cultivated. The common crops are hardy vegetables, potatoes, oats, barley, and grasses grown for hay and pasture. Management group 3 (IIw–1).

Beluga silt loam, moderately sloping (7 to 12 percent slopes) (BaC).—This soil is mainly in broad areas on fairly uniform slopes, but some areas adjacent to high escarpments are dissected by drainageways. Runoff is medium, and the hazard of water erosion is moderate.

Included with this soil in mapping are patches of Kachemak soils and of Mutnala soils.

Most of the acreage of this soil is in native vegetation that consists of bluejoint reedgrass, fireweed, and a sparse forest of Sitka spruce and paper birch. Some areas are cultivated. The common crops are hardy vegetables, potatoes, oats, barley, and grasses grown for hay and pasture. Management group 9 (IIIw–3).

Beluga silt loam, strongly sloping (12 to 20 percent slopes) (BaD).—This soil commonly borders the base of high escarpments (fig. 2). Slopes are short and dissected in most places. Angular fragments of shale occur throughout the profile. Runoff is medium to rapid, and erosion is a moderate to severe hazard.

Included with this soil in mapping are small areas of the well-drained Kachemak and Mutnala soils.

This soil is mostly in native vegetation consisting of bluejoint reedgrass, fireweed, and a sparse forest of Sitka spruce and paper birch. It is suited to an occasional cultivated crop if management is good and includes the control of erosion. The principal crops are hardy vegetables, potatoes, oats, barley, and grasses grown for hay and pasture. Management group 12 (IVw–2).

Bernice Series

The Bernice series consists of excessively drained, strongly sloping to steep soils that border streams, lakes, and muskegs, mainly in the northern part of the survey area. These soils formed in gravelly glacial drift or gravelly alluvium. The native vegetation is a forest of white spruce, quaking aspen, and paper birch. Bernice soils are most extensive at elevations of 50 to 500 feet, but a few areas in the Caribou Hills are higher than 500 feet. The mean annual precipitation is 19 to 24 inches, and the average annual air temperature ranges from 34° to 37° F.

The Bernice soils have a thin mat of forest litter over a grayish-brown sandy loam or silt loam surface layer 1 to 2 inches thick. The subsoil extends to a depth of 4 to 8 inches and is dark reddish-brown and dark-brown silt loam. The underlying material is dark-gray gravelly sandy loam and very gravelly loam.

The Bernice soils have low available moisture capacity and rapid permeability. Plant roots penetrate to a depth of 18 inches. Fertility is low.

These soils are forested and are used as wildlife habitat.

Typical profile of Bernice sandy loam, strongly sloping to steep, SW¼NW¼, sec. 11, T. 5. S., R. 15 W., Kenai Peninsula:

Figure 2.—**Cattle grazing in an area of Beluga silt loam, strongly sloping. This area is below the escarpment that marks the edge of the Caribou Hills. Rough broken land occurs on the escarpment.**

O11—3 to 2 inches, undecomposed organic material; many mycelia; abrupt, smooth boundary.

O12—2 inches to 0, dark reddish-brown (5YR 3/2), partly decomposed organic material; many roots; very strongly acid; abrupt, smooth boundary.

A2—0 to 1 inch, grayish-brown (10YR 5/2) silt loam; weak, very thin, platy structure; very friable; common roots; thin layer of sand- and fine sand-sized volcanic ash at top of horizon; very strongly acid; abrupt, smooth boundary.

B2—1 to 3 inches, dark reddish-brown (5YR 3/3 and 5YR 2/2) silt loam; weak, very fine, granular structure; smeary when rubbed; common roots; very strongly acid; clear, wavy boundary.

B3—3 to 5 inches, dark-brown (7.5YR 3/2) silt loam; streaks of brown (10YR 4/3) fine sandy loam; weak, very thin, platy structure; very friable; roots common; some rounded gravel; very strongly acid; clear, wavy boundary.

C1—5 to 14 inches, dark-gray (5Y 4/1) gravelly sandy loam; streaks and patches of dark brown (7.5YR 3/2 and 10YR 3/3); single grain (structureless); loose; few roots; dark-brown stains (10YR 3/3) on pebbles; very strongly acid; abrupt, smooth boundary.

C2—14 to 24 inches, streaks and patches of dark-gray (5Y 4/1) and dark grayish-brown (2.5Y 4/2) very gravelly loam; medium, fine, angular blocky structure; firm; few roots; very strongly acid.

The A horizon ranges from silt loam to sandy loam. In places the soil horizons have been distorted by frost action or soil creep. Depth to gravelly material ranges from 5 to 12 inches. Pebbles and stones make up more than 50 percent of the C horizon. The C horizon contains strata of medium-textured material in some places.

The Bernice soils are associated with the well-drained Cohoe soils and with the well-drained Mutnala soils on rolling to steep, glacial moraines. The mantle of silt loam

and the soil horizons are thinner in the Bernice soils than in the Cohoe and Mutnala soils.

Bernice sandy loam, strongly sloping to steep (12 to 45 percent slopes) (BeE).—This soil is shallow to gravel, droughty, and low in fertility. Roots penetrate to a depth of 18 inches. Runoff is medium to rapid.

Included with this soil in mapping are small areas of the Mutnala and Cohoe soils.

This soil is suited only to trees and as wildlife habitat. It is too steep, shallow, and droughty for farming. Management group 19 (VIIe–2).

Coal Creek Series

The Coal Creek series consists of poorly drained, nearly level to strongly sloping soils that occur on foot slopes and along drainageways, mainly at high elevations in the Caribou Hills. These soils are most extensive at elevations of 800 to 1,600 feet, but a few areas are lower. The average annual air temperature is 34° to 37° F., and the mean annual precipitation is 24 to 28 inches. The native vegetation consists of willows, black spruce, bluejoint reedgrass and other tall grasses, and of other plants tolerant of cool, wet soils.

The Coal Creek soils normally have a mat of partly decomposed organic material 4 to 6 inches thick. It is over very dark brown or dark grayish-brown silt loam about 3 to 12 inches thick. The underlying material is mottled dark grayish-brown to dark greenish-gray silt loam that extends to a depth of 15 to 35 inches. Below this it is firm, olive-gray to dark greenish-gray gravelly silt loam.

The Coal Creek soils have moderate available water capacity. Permeability is moderate, and fertility is low.

Most of the acreage of these soils is used as wildlife habitat, but some areas are used for grazing.

Typical profile of Coal Creek silt loam, gently sloping, SE¼SE¼, sec. 23, T. 5 S., R. 13 W., Kenai Peninsula:

O11—6 to 2 inches, undecomposed mat of leaves, twigs, and grass straw.

O12—2 inches to 0, dark reddish-brown (5YR 2/2) mat of mostly decomposed organic matter mixed with silty material; abrupt, smooth boundary.

A1—0 to 3 inches, very dark brown (10YR 2/2) silt loam; common, medium, faint mottles of dark grayish brown (2.5Y 4/2); thin irregular streaks of black (5Y 2/1); weak, very fine, granular structure; very friable; many roots; very strongly acid; clear, smooth boundary.

C1g—3 to 9 inches, olive-gray (5Y 4/2) silt loam; many, medium, prominent mottles of dark brown (7.5YR 3/2); irregular streaks of dark grayish brown (2.5Y 4/2) weak, very thin, platy structure; friable; common roots; few angular pebbles; very strongly acid; clear, smooth boundary.

C2g—9 to 15 inches, dark greenish-gray (5GY 4/1) silt loam; common, medium, distinct mottles of olive brown (2.5Y 4/4) and brown (7.5YR 4/4); weak, very thin, platy structure; friable; few roots; few angular pebbles; thin irregular strata of fine sand; very strongly acid; gradual wavy boundary.

C3g—15 to 31 inches, dark greenish-gray (5GY 4/1) gravelly silt loam; massive (structureless); firm; few stones as much as 6 inches in diameter; irregular strata of sand and silty clay loam; gravel increases with depth; very strongly acid.

The mat of organic material ranges from 3 to 10 inches in thickness. An A1 horizon is not present in some places. The C horizon contains thin strata of fine sandy loam, sand, and silty clay loam in some places. The upper part of the C horizon ranges from dark gray to dark greenish gray mottled with dark grayish brown and dark brown. Depth to the C3 horizon is 12 to 25 inches. The gravel and rounded stones generally are less than 25 percent of the C3 horizon, but in some places they are as much as 50 percent.

The Coal Creek soils are associated with the well-drained Kachemak and Mutnala soils on adjacent uplands. Unlike the Kachemak and Mutnala soils, the Coal Creek soils are mottled and have other characteristics of wet soils.

Coal Creek silt loam, nearly level (0 to 3 percent slopes) (CkA).—This soil generally occurs on narrow flood plains along the headwaters of streams in the Caribou Hills. It is always wet from seepage and is commonly flooded during spring thaws. Runoff is very slow or ponded, but some areas are eroded by floodwaters from higher adjoining areas.

Included with this soil in mapping are patches of Salamatof peat, Moose River silt loam, and Slikok mucky silt loam.

This soil is mostly in native vegetation that consists of willow, black spruce, and bluejoint reedgrass. The main use is for wildlife, but a few areas are grazed. If this soil were drained, it could be used for hay crops and pasture but planting would be delayed later in spring than on the well-drained soils at lower elevations. Plant growth would also be restricted by the low temperature of the soil. Management group 13 (IVw–3).

Coal Creek silt loam, gently sloping (3 to 7 percent slopes) (CkB).—This soil occupies long, narrow areas on foot slopes and small drainageways on uplands. Flooding is not so frequent on this soil as it is on Coal Creek silt loam, nearly level. Undrained areas are always wet because seepage is received from higher areas. Runoff is slow, and the hazard of erosion is only slight. This soil has the profile described as typical for the series.

Included with this soil in mapping are a few areas of Kachemak soils and a few areas of the moderately sloping Coal Creek soils.

Native vegetation, mainly willow, black spruce, and bluejoint reedgrass, covers most of the acreage of this soil. Most areas are used only by wildlife, but some areas are used for grazing. Management group 13 (IVw–3).

Coal Creek silt loam, moderately sloping (7 to 12 percent slopes) (CkC).—This soil is in long, narrow areas on foot slopes. It is not subject to flooding, but it is always wet from seepage. Runoff is medium, and erosion is a moderate hazard.

Included with this soil in mapping are patches of the Kachemak soils and a few areas of Coal Creek soils that have slopes of more than 12 percent.

The native vegetation on this soil consists of black spruce and an undergrowth of willows. Some areas are suitable for limited grazing. In most places artificial drainage is not practical, because the areas are so narrow. In places where drainage is practical, common crops can be grown. Management group 9 (IIIw–3).

Coal Creek silt loam, strongly sloping (12 to 20 percent slopes) (CkD).—This soil generally occurs on foot

slopes in valleys. Runoff is medium to rapid, but seepage from higher areas keeps this soil wet. If this soil were cultivated, erosion would be a hazard.

Included with this soil in mapping are patches of the Kachemak soils.

All of this soil is in native vegetation consisting of black spruce and willow. Artificial drainage is not practical in most places, but grasses can be grown in areas that can be drained. Management group 12 (IVw–2).

Cohoe Series

The Cohoe series consists of deep, well-drained, nearly level to steep soils. These soils are extensive in the northern part of the survey area. They formed in silty, wind-laid deposits that have an admixture of volcanic ash. In most places this silty material is above layered silty and sandy sediments of the Kenai formation. The natural vegetation is a forest of white spruce and paper birch. The elevation ranges from 50 to 800 feet. The mean annual precipitation is 19 to 21 inches, and the average annual air temperature ranges from 34° to 36° F.

The Cohoe soils have a mat of forest litter over a leached, dark-gray silt loam surface layer 2 to 3 inches thick. The subsoil extends to a depth of 15 to 18 inches and is reddish-brown to dark yellowish-brown silt loam. The underlying material is olive silt loam to a depth of 24 to 40 inches. Below that are layers of olive-gray sand, gravelly sandy loam, and gravelly silt loam.

The Cohoe soils have moderate available water capacity. Permeability is moderate. Plant roots penetrate to a depth of 20 to 30 inches. Fertility is low.

Most of the acreage of these soils is forested, but some areas have been cleared and used for cultivated crops, hay, and pasture.

Typical profile of Cohoe silt loam, gently sloping, SW¼NW¼, sec. 7, T. 2 S., R. 13 W., Kenai Peninsula.

O1—4 inches to 0, mat of organic material; reddish-gray (5YR 5/2) mycelia throughout horizon; many roots; very strongly acid; abrupt, smooth boundary.

A2—0 to 3 inches, dark-gray (10YR 4/1) silt loam; common, medium, distinct mottles of very dark grayish brown; pockets of fine, sandy volcanic ash; weak, very fine, granular structure; very friable; many roots; contains fragments of charcoal; very strongly acid; abrupt, wavy boundary.

B21—3 to 4 inches, reddish-brown (5YR 4/4) silt loam; weak, very fine, granular structure; very friable; roots common; very strongly acid; abrupt, broken boundary.

B22—4 to 7 inches, dark-brown (7.5YR 4/4) silt loam; weak, very fine, subangular blocky structure; very friable; roots common; very strongly acid; clear, wavy boundary.

B3—7 to 17 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, very thin, platy structure; very friable; few roots; many fine pores; very strongly acid; clear, wavy boundary.

C1—17 to 25 inches, olive (5Y 5/3) silt loam; weak, very thin, platy structure; very friable; few roots; pebbles in lower 2 inches; strongly acid; abrupt, wavy boundary.

IIC2—25 to 39 inches, olive-gray (5Y 4/2) sand; single grain; loose; few roots; few rounded pebbles at top of horizon; thin lenses of olive-gray silt loam throughout; strongly acid; abrupt, smooth boundary.

IIIC3—39 to 58 inches, olive-gray (5Y 5/2) gravelly sandy loam; massive; firm; no roots; many pores and vesicles; irregular seams of silt loam; strongly acid; abrupt, smooth boundary.

IIIC4—58 to 80 inches, olive-gray (5Y 5/2) fine sand; single grain; loose; no roots; silty lenses in upper part; strongly acid.

In some places thin lenses of sand-sized volcanic ash occur in the uppermost 6 inches of the profile. Patches of dark reddish brown and dark brown commonly are in the horizon. The C horizon is mottled in some nearly level areas. Depth to the IIC horizon ranges from 24 to 42 inches. The IIIC horizon consists of layered soft shale and sandstone in some places, but in areas bordering streams it is gravelly terrace deposits.

The Cohoe soils are associated mainly with the well-drained Island soils in grass-covered shallow depressions and with the Spenard soils on muskeg borders. Cohoe soils lack the thick, dark-colored A horizon of the Island soils, and have a reddish-brown, dark-brown, and dark yellowish-brown B horizon, which is lacking in the Island soils. The Cohoe soils also lack the mottled, massive IIC horizon of the Spenard soils.

Cohoe silt loam, nearly level (0 to 3 percent slopes) (CoA).—This is an extensive soil that has some areas several hundred acres in size. Areas of this soil grade to rolling areas or are bordered by steep escarpments. Because surface drainage is very slow to slow, this soil does not warm up or dry out so fast as the more sloping Cohoe soils. There is a hazard of erosion on long, unprotected slopes.

Included with this soil in mapping, in areas bordering muskegs, are small areas of the somewhat poorly drained Spenard soils. Also included in the mapping, on terraces along the lower part of the Anchor River, are areas of soils that resemble the Mutnala soils except that the included soils are more than 24 inches deep over very gravelly underlying material.

Most of the acreage of this soil is wooded, but a few areas have been cleared and are used for cultivated crops. The common crops are hardy vegetables, potatoes, oats, barley, and grasses grown for hay and pasture. Management group 2 (IIc–1).

Cohoe silt loam, gently sloping (3 to 7 percent slopes) (CoB).—This soil occupies many large areas. The slopes are long and relatively uniform in most places, but short slopes also occur. This soil has the profile described as typical for the series. Runoff is slow to medium, and erosion is a slight to moderate hazard, especially in spring or during long rainy periods.

Included with this soil in mapping are small areas of Spenard soils. Also included, near Ninilchik, are a few areas where gravelly silt loam is at a depth of 20 to 30 inches. Other inclusions are a few areas of undulating soils that generally have very gravelly underlying material.

Most of the acreage of this soil is wooded, but some areas have been cleared and cultivated. The principal crops are hardy vegetables, potatoes, oats, barley, and grasses grown for pasture and hay. Management group 1 (IIe–1).

Cohoe silt loam, moderately sloping (7 to 12 percent slopes) (CoC).—This soil generally borders areas of nearly level and gently sloping Cohoe silt loam, but it

also occurs in a few narrow bands that border muskegs. In most places, slopes are relatively short and uniform; a few areas are rolling. Runoff is medium, and erosion is a moderate hazard.

Included with this soil in mapping are a few areas of soils that are underlain by gravelly material at a depth of less than 30 inches.

Most of the acreage is in trees, but a few areas have been cleared and are used for cultivated crops. The principal crops are hardy vegetables, potatoes, and grasses grown for hay and pasture. Management group 4 (IIIe–1).

Cohoe silt loam, strongly sloping (12 to 20 percent slopes) (CoD).—This soil commonly borders broad areas of the less strongly sloping Cohoe soils and is in some areas above muskegs and streams. Runoff is medium to rapid. The hazard of water erosion is moderate.

Included with this soil in mapping are small areas of Mutnala soils and steeper Cohoe soils.

This soil is mostly woodland, but it is suited to improved pasture and to hay. Management group 10 (IVe–1).

Cohoe silt loam, moderately steep (20 to 30 percent slopes) (CoE).—This soil occurs on valley side slopes and on short escarpments. Generally, this soil has a thinner silty mantle than the less sloping Cohoe soils, and the underlying material contains more gravel. Runoff is moderate to rapid, and the hazard of water erosion is moderate to severe.

Included with this soil in mapping are patches of Bernice soils and patches of Mutnala soils.

This soil is entirely woodland, but it is suited to improved pasture. Management group 14 (VIe–1).

Cohoe silt loam, steep (30 to 60 percent slopes) (CoF).—Except for the slope, this soil is similar to Cohoe silt loam, moderately steep. Runoff is rapid, and the hazard of water erosion is severe.

Included with this soil in mapping are small areas of Bernice soils and of Grewingk soils.

All of this soil is woodland. It can be used for permanent pasture, but it is better to leave most areas in trees. Management group 18 (VIIe–1).

Doroshin Series

The Doroshin series consists of very poorly drained, level to moderately sloping peat soils. These soils occur mainly on the edges of small lakes and broad muskegs. In some places they make up entire muskegs, or they occupy slopes that are kept wet by seepage. The Doroshin soils consist of layers of moss and sedge peat in various stages of decomposition. The native vegetation is mainly a dense growth of sphagnum moss, sedges, horsetail, dwarf birch, Labrador-tea, and other low-growing plants. Stands of black spruce grow in some areas. The elevation generally is less than 800 feet. The mean annual precipitation is 19 to 21 inches, and the average annual air temperature ranges from 34° to 36° F.

In the Doroshin soils peat extends from the surface to a depth of 18 to 30 inches. The uppermost 6 to 15 inches is undecomposed sphagnum moss peat. Below this are layers of partly decomposed sedge peat and moss peat. In some places the entire soil consists of decomposed sedge peat. The underlying material is mottled very dark grayish-brown and dark grayish-brown silt loam and grayish-brown silty clay loam.

The Doroshin soils have high available water capacity. Permeability is moderate.

These soils are used for grazing and as wildlife habitat.

Typical profile of Doroshin peat, nearly level, NW¼ NE¼, sec. 32, T. 4 S., R. 14 W., Kenai Peninsula:

2 inches to 0, mat of living sphagnum moss.

Oi1—0 to 9 inches, coarse moss peat that is dark reddish brown (5YR 3/2) when wet, yellowish brown (10YR 5/4) when squeezed dry; many roots; extremely acid; gradual boundary.

Oi2—9 to 13 inches, coarse moss peat that is very dark brown (10YR 2/2) when wet, brown (10YR 4/3) when squeezed dry; thin layer of gray (10YR 6/1) silty volcanic ash near the surface of horizon; extremely acid; many roots; gradual boundary.

Oe1—13 to 19 inches, coarse moss peat, woody fragments, and thin layers of sedge peat that are very dark grayish brown (10YR 3/2) when wet, dark grayish brown (10YR 4/2) when squeezed dry; extremely acid; abrupt, wavy boundary.

IIC1—19 to 23 inches, very dark grayish-brown (10YR 3/2) silt loam; massive; slightly firm; extremely acid; abrupt, wavy boundary.

IIC2—23 to 30 inches, dark grayish-brown (2.5Y 4/2) silt loam; massive; slightly firm; extremely acid; abrupt, wavy boundary.

IIC3—30 to 36 inches, grayish-brown (10YR 5/2) silty clay loam; common, medium, faint mottles of brown (10YR 4/3), grayish brown (10YR 5/2), olive brown (2.5Y 4/4), and dark greenish gray (5BG 4/1); massive; firm; extremely acid.

The peat ranges from 18 to 30 inches in thickness. In some places it is soft and fibrous, but in other places it is finely divided throughout the profile. Thin layers of volcanic ash commonly occur in the uppermost 12 inches of the profile. The substratum is pebbly silt loam in places.

The Doroshin soils are associated with the very poorly drained Salamatof soils in the muskegs and with the somewhat poorly drained Spenard soils bordering muskegs. The peat layer in the Doroshin soils is not so thick and is more finely divided than that in the Salamatof soils. The Doroshin soils are organic, but the Spenard soils are mineral and have a IIC horizon of firm material.

Doroshin peat, nearly level (0 to 3 percent slopes) (DoA).—This soil commonly occurs at the edges of lakes or in muskegs. The water table generally is at or near the surface. Runoff is ponded. Erosion is not a hazard. This soil has the profile described as typical for the series.

Included with this soil in mapping are small areas of Salamatof peat and of Slikok mucky silt loam, nearly level.

This soil is used as wildlife habitat. If this soil were drained, it would have little value for farming other than limited grazing. Management group 21 (VIIw–2).

Doroshin peat, gently sloping (3 to 7 percent slopes) (DoB).—This soil occupies muskeg borders and seepy foot slopes, and it is always wet. In many areas spindly black spruce grows in sparse stands.

Included with this soil in mapping are small areas of Salamatof peat and a few shallow spots where the organic material is less than 12 inches deep to the mineral underlying material.

Limited grazing is the only farm use suited to this soil. Management group 21 (VIIw–2).

Doroshin peat, moderately sloping (7 to 12 percent slopes) (DoC).—This soil occupies foot slopes that receive seepage from higher wet areas, and it is always wet. In many places black spruce grows in sparse stands.

This soil is used mainly as wildlife habitat. It may be easier to drain than are the less sloping Doroshin soils, but it has little value for farming. Management group 21 (VIIw–2).

Gravelly Beach

Gravelly beach (Gb) occurs along the coast in narrow areas between the sea and the cliffs. Very little vegetation grows in these areas. The lower parts of the beach are under water every day during high tides. When exposed between high tides the areas are smooth and firm and are used as a roadway. The higher parts of the beach are hummocky and commonly are bouldery. Muddy or marshy areas occur at the mouths of most streams that cross the beach. Management group 23 (VIIIw–1).

Grewingk Series

The Grewingk series consists of somewhat poorly drained, strongly sloping to steep soils that formed in stratified gravelly silt and sand. Because these soils are on north-facing slopes and escarpments, they remain frozen until late in summer. In most places, paper birch, black spruce, and white spruce grow in a sparse stand, and there are many willows and other low-growing plants. The elevation ranges from 50 to 1,000 feet. The average annual air temperature ranges from 34° to 37° F., and the mean annual precipitation is 21 to 24 inches.

On the surface of Grewingk soils is a layer of sphagnum moss 8 to 17 inches thick. Beneath this is mottled dark grayish-brown silt loam that is 1 to 2 inches thick and dark reddish-brown silt loam that is 1 to 4 inches thick. The next layer is dark-brown gravelly sandy loam 3 to 5 inches thick. The underlying material begins at a depth of 5 to 8 inches and consists of a layer of olive gravelly sand that varies in thickness and of olive gravelly clay loam.

The Grewingk soils have low to moderate available water capacity. Permeability is moderate. Fertility is low, and roots penetrate to a depth of 10 to 20 inches.

These soils can be grazed to a limited extent. They have little value for farming.

Typical profile of Grewingk fine sandy loam, strongly sloping to steep, NE¼SW¼, sec. 9, T. 6 S., R. 14 W., Kenai Peninsula:

O11—9 to 3 inches, raw sphagnum moss; many roots.

O12—3 inches to 0, dark reddish-brown (5YR 2/2), partly decomposed moss, twigs, and roots; slight admixture of volcanic ash, particularly near bottom of horizon; many roots; very strongly acid; abrupt, wavy boundary.

A2—0 to 1½ inches, dark grayish-brown (2.5Y 4/2) coarse silt loam; common, medium, faint mottles of brown (10YR 4/3); weak, thin, platy structure; very friable; few roots; very strongly acid; abrupt, wavy boundary.

B21—1½ to 4 inches, dark reddish-brown (5YR 3/2 and 3/4) gritty silt loam; weak, thin, platy structure; friable; slightly brittle at top of horizon; few roots; smeary when rubbed; few pebbles having stains on surface; very strongly acid; clear, wavy boundary.

IIB22—4 to 8 inches, dark-brown (7.5YR 3/4) gravelly sandy loam; streaks of dark reddish brown (5YR 2/2); weak, thin, platy structure; friable; few roots; smeary when rubbed; few fine concretions of manganese; very strongly acid; abrupt, wavy boundary.

IIC1—8 to 17 inches, olive (5Y 4/3) gravelly sand; single grain (structureless); loose; few roots; very strongly acid; abrupt, wavy boundary.

IIIC2—17 to 24 inches, olive (5Y 5/3) gravelly clay loam; common, coarse, distinct mottles of yellowish brown (10YR 5/4); fine angular blocky structure, blocks are arranged in rough plates; firm, few roots; very strongly acid.

The A horizon ranges from silt loam to fine sand. The B horizon commonly has streaks and patches of brown and dark reddish brown. Depth to the gravelly material ranges from 5 to 12 inches. The C horizon is stratified in some places. The strata range from gravelly clay loam to gravelly sandy loam.

The Grewingk soils are associated with the excessively drained Bernice soils on escarpments that do not face north and with the well-drained Mutnala soils on uplands. The Grewingk soils are mottled and show other evidence of wetness, but the Bernice and Mutnala soils do not.

Grewingk fine sandy loam, strongly sloping to steep (12 to 45 percent slopes) (GrE).—This soil is on north-facing slopes, and it is cold and wet. Runoff is medium to rapid, depending on slope. Erosion is a moderate to severe hazard.

This soil has little value for farming, but it can be used for limited grazing. Management group 20 (VIIw–1).

Island Series

The Island series consists of well-drained, nearly level to moderately steep soils that occur mainly in the northern part of the survey area. These soils are mostly in slight depressions surrounded by the Cohoe soils, but they also occupy low hills bordering the sea cliffs. Island soils formed in a mixture of silty wind-laid material and volcanic ash. This material commonly is more than 30 inches thick over layered soft shale and sandstone sediments of the Kenai formation. The soil surface is very hummocky; hummocks are closely spaced and are as much as 18 inches high and 6 feet wide. The native vegetation is mostly grass, mainly native fescues and bluejoint reedgrass, but fireweed and other broad-leaf plants are mixed with the grass in some areas. White spruce is invading most areas. These soils mostly occur below elevations of 800 feet. The mean annual precipitation is 19 to 21 inches, and the average annual air temperature ranges from 34° to 36° F.

The Island soils have a thin mat of organic material over brown and very dark brown silt loam 16 to 22 inches thick. Below this is brown and very dark brown silt loam that extends to a depth of 30 to 60 inches. It is underlain by olive-gray silt loam and fine sand over strata of soft shale and sandstone.

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The Island soils have moderate to high available water capacity. Permeability is moderate. Roots penetrate to a depth of 20 to 30 inches, and fertility is low.

In most places these soils are used for grazing and as wildlife habitat, but a few areas are planted to cultivated crops.

Profile of Island silt loam, nearly level, SW¼SE¼, sec. 3, T. 2 S., R. 14 W., Kenai Peninsula:

O1—2½ inches to 0, mat of very dark brown (10YR 2/2) organic material and admixture of silt loam; thin layer of fine sand-sized volcanic ash at base of horizon; abrupt, smooth boundary.

A11—0 to 1½ inches, brown (10YR 4/3) silt loam; weak, fine, granular structure; very friable; many roots; strongly acid; may be recent ash; abrupt, broken boundary.

A12—1½ to 6 inches, very dark brown (10YR 2/2) silt loam; weak, very thin, platy structure; smeary; many roots; few small fragments of charcoal; strongly acid; clear, wavy boundary.

A13—6 to 19½ inches, very dark brown (10YR 2/2) silt loam; streaks and patches of brown (10YR 4/3); weak, very thin, platy structure; smeary; common roots; few small fragments of charcoal; patches of brown (10YR 4/3) ash at depth of 16 inches; fine streaks of brown ash throughout horizon; strongly acid; abrupt, wavy boundary.

A14—19½ to 27 inches, brown (10YR 4/3) silt loam; patches of very dark brown (10YR 3/2); weak, very thin, platy structure; smeary; few roots; many fine pores; strongly acid; abrupt, wavy boundary.

A11b—27 to 30 inches, very dark brown (10YR 3/2) silt loam; streaks of brown (10YR 4/3), dark yellowish brown (10YR 4/4), and olive brown (2.5Y 4/4); very weak, very thin, platy structure; smeary; few roots; many fine vesicles and pores; streaks from A12b horizon; strongly acid; abrupt, broken boundary.

A12b—30 to 37 inches, brown (10YR 4/3) silt loam; very weak, very thin, platy structure; smeary; few roots; many fine vesicles and pores; strongly acid; abrupt, smooth boundary.

IIC1—37 to 42 inches, olive-gray (5Y 5/2) silt loam; common, large, faint mottles of olive (2.5Y 5/4); weak, thin, platy structure; very friable; many vesicles and pores; strongly acid; abrupt, smooth boundary.

IIIC2—42 to 48 inches, olive-gray (5Y 4/2) fine sand; common, medium, distinct mottles of dark yellowish brown (10YR 4/4): weak, fine, platy structure; very friable; strong-brown (10YR 5/6) stains along pores; strongly acid.

A layer of pebbles is below a depth of 18 inches in some places. In the few areas at higher elevations in the Caribou Hills, gravelly glacial drift is at a depth of about 18 inches.

The Island soils are associated mainly with the well-drained Cohoe and Mutnala soils on uplands and with the poorly drained and somewhat poorly drained Nikolai soils in upland depressions. Island soils have a thick, dark-colored A horizon, but Cohoe and Mutnala soils do not.

Island silt loam, nearly level (0 to 3 percent slopes) (IaA).—This soil makes up about one-half of the acreage mapped as Island soils in the survey area. It has the profile described as typical for the series (fig. 3). This soil occupies shallow depressions on uplands. Runoff is very slow, and the hazard of water erosion is slight or more. Soil blowing is likely in unprotected areas bordering the coast.

Included with this soil in mapping are small areas of Nikolai silt loam and of Salamatof peat.

Figure 3.—**Profile of Island silt loam, nearly level.**

Most of the acreage of this soil is in native grasses and is used for pasture and wildlife habitat. A few areas have been smoothed and cultivated. The common crops are hardy vegetables, potatoes, oats, barley, and grasses and legumes grown for hay and pasture. Management group 2 (IIc–1).

Island silt loam, gently sloping (3 to 7 percent slopes) (IaB).—This soil occupies borders of depressions and tops of some low hills near the coast. Except for slope, it is similar to Island silt loam, nearly level. Runoff is slow, but erosion is a slight hazard.

Included with this soil in mapping are a few areas of steeper Island soils and a few spots of Cohoe silt loam, gently sloping.

Most of this soil is in native vegetation, but a few areas are used for hardy vegetables, potatoes, oats, barley, and grasses grown for hay and pasture. Management group 1 (IIe–1).

Island silt loam, moderately sloping (7 to 12 percent slopes) (IaC).—This soil occupies side slopes and narrow ridges in hilly areas that border the sea cliffs. It has medium runoff. On this soil, the hazard of water erosion is moderate, and that of soil blowing is moderate to severe.

Included with this soil in mapping are many areas where the surface layer is very fine sandy loam and depth to the underlying strata or glacial till is more than 50 inches. The slightly coarser material in the surface layer was blown from adjoining beaches. Because of these additions, natural fertility of the included areas is higher than that of Island soils in depressions.

This soil is used mainly for hardy vegetables, potatoes, oats, barley, and grasses grown for hay and pasture. In a few areas the native grasses are pastured. Management group 4 (IIIe–1).

Island silt loam, strongly sloping (12 to 20 percent slopes) (IaD).—This soil occupies low hills that border the coast. Except for the slope, it is similar to Island silt loam, moderately sloping. Runoff is medium to rapid, and the hazard of water erosion is moderate to severe. Soil blowing is a severe hazard on slopes that face the sea and is a moderate hazard on other slopes.

Small scattered areas of this soil are cultivated. The principal crops are hardy vegetables, potatoes, oats, barley, and grasses grown for hay and pasture. Management group 10 (IVe–1).

Island silt loam, moderately steep (20 to 30 percent slopes) (IaE).—Except for the slope, this soil is similar

Figure 4.—**A grassy area of Kachemak soils in the Caribou Hills. The trees are Sitka spruce.**

to Island silt loam, moderately sloping. Runoff is medium to rapid, and the hazard of water erosion is severe. Soil blowing is a moderate to severe hazard, particularly on slopes that face the sea.

Included with this soil in mapping are a few areas of steeper soils.

This Island soil is mostly in native grasses. Most areas are idle, but a few are grazed. Management group 14 (VIe-1).

Kachemak Series

The Kachemak series consists of dark-colored, well-drained, shallow to moderately deep soils that occur on uplands and are nearly level to steep. These soils formed in volcanic ash mixed with silt blown from recently exposed glacial drift. Below the volcanic ash are layers of moderately consolidated shale and sandstone. The elevations range from 800 to 2,000 feet.

Kachemak soils are the most extensive soils in the Caribou Hills. The native vegetation consists mainly of bluejoint reedgrass, forbs, and shrubs. Clumps of Sitka spruce are common at elevations of less than 1,400 feet (fig. 4). Alder and willows grow in thickets at high elevations and in drainageways. At elevations of more than 1,500 feet, native grasses are not so tall as they are at lower elevations. The mean annual precipitation is about 28 inches, and the average annual air temperature is about 37° F. About 100 inches of snow falls annually. At higher elevations and on north-facing slopes, soil temperature is lower and the growing season is shorter than they are at lower elevations.

In undisturbed areas the Kachemak soils are covered by a mat of partly decomposed organic material, mostly straw, as much as 8 inches thick. This mat is over 2 or 3 inches of recent volcanic ash. Below the layer of ash is dark-brown and dark reddish-brown slit loam 14 to 30 inches thick. The next layer is olive-gray silt loam. Below the silt loam are strata of soft shale and sandstone or glacial drift. Glacial drift occurs only at elevations of 1,500 feet or more.

The Kachemak soils have moderate to high available water capacity. Permeability is moderate. Roots penetrate to a depth of 20 to 30 inches or more. Fertility is low.

These soils are mostly in native vegetation, but some areas are used for cultivated crops, hay, and pasture.

Typical profile of Kachemak silt loam, gently sloping, SE¼SE¼, sec. 7, T. 6 S., R. 13 W., Kenai Peninsula:

O—3 inches to 0, mat of roots, leaves, and stems; many fragments of charcoal; thin lens of white sand grains at base of horizon; extremely acid; abrupt, smooth boundary.

C—0 to 2½ inches, recent volcanic ash of dark-brown (7.5YR 3/3) to dark reddish-brown (5YR 3/4) silt loam texture; weak, very fine, granular structure; very friable; roots common; lower part of horizon contains charred organic residues; extremely acid to very strongly acid; abrupt, wavy boundary.

A2b—2½ to 5 inches, dark-brown (7.5YR 3/2) silt loam; weak, very fine, granular structure; very friable before rubbing, releases water and becomes smeary when rubbed; roots common; very strongly acid; abrupt, wavy boundary.

B21b—5 to 7 inches, very dusky red (2.5YR 2/2) silt loam; weak, very fine, granular structure; very friable before rubbing, releases water and becomes smeary when rubbed; roots common; very strongly acid; clear, wavy boundary.

B22b—7 to 11 inches, dark reddish-brown (5YR 3/3) silt loam; weak, very fine, granular structure; very friable before rubbing, releases water and becomes smeary when rubbed; roots common; strongly acid; gradual, wavy boundary.

B3b—11 to 14 inches, dark reddish-brown (5YR 3/3) silt loam; patches of dark brown (7.5YR 4/4); weak, fine, subangular blocky structure; very friable before rubbing, releases water and becomes smeary when rubbed; roots common; strongly acid, gradual, wavy boundary.

C1—14 to 17 inches, dark-brown (10YR 4/3) silt loam; weak, medium, subangular blocky structure; very friable before rubbing, releases water and becomes smeary when rubbed; fine pores; strongly acid; abrupt, wavy boundary.

IIC2—17 to 23 inches, olive-gray (5Y 5/2) silt loam streaked with dark grayish brown (2.5Y 4/2); few pebbles; moderate, thin, platy structure that breaks to weak, very fine, angular blocky structure; friable; fine pores; strongly acid; gradual, wavy boundary.

IIC3—23 to 39 inches, olive-gray (5Y 5/2) silt loam; common, medium, faint mottles of olive brown (2.5Y 4/4); few pebbles; moderate, thin, platy structure; friable; fine pores; strongly acid; abrupt, smooth boundary.

R—39 inches, moderately consolidated shale.

In some places lenses of sand-size volcanic ash occur in the uppermost 8 inches of the profile. In areas at higher elevations, the surface is commonly covered with closely spaced hummocks as much as 3 feet high and several feet in diameter.

The Kachemak soils are associated with the well-drained Mutnala soils of forested uplands and with the very poorly drained Starichkof soils of muskegs. The Kachemak soils lack the bleached grayish A2 horizon of the Mutnala soils. Although the Kachemak soils are high in organic-matter content, they are not peat soils as are the Starichkof soils.

Kachemak silt loam, nearly level (0 to 3 percent slopes) (KhA).—This soil is at elevations of more than 1,500 feet. It has an extremely hummocky surface and, in some places, a mottled subsoil. The underlying material is gravelly glacial till in most places. Runoff is slow, and the hazard of erosion is slight to none. This soil is slow to dry and to warm in spring, and it remains cool throughout the summer.

Included with this soil in mapping are small areas of poorly drained Starichkof peat.

This soil is in natural vegetation, mainly willows and grasses. Its chief use is wildlife habitat, but it is suited to grazing in summer. Management group 15 (VIc-1).

Kachemak silt loam, gently sloping (3 to 7 percent slopes) (KhB).—This soil generally occurs in small areas on benches and ridgetops. It has the profile described as typical for the series. Depth to the underlying material is commonly more than 24 inches; in some areas at elevations of more than 1,500 feet, this soil is underlain by gravelly till at a depth of 14 inches. At an elevation of more than 1,200 feet and on north-facing slopes, this soil is very slow to warm and dry in spring. Runoff is slow, and water erosion is a slight hazard on unprotected, long slopes.

Included with this soil in mapping are a few wet spots and small areas of the well-drained Mutnala soils.

This soil is covered mainly by bluejoint reedgrass and associated plants. In a few areas hardy vegetables, potatoes, oats, barley, and grasses for hay and pasture are grown (fig. 5). Management group 5 (IIIe–2).

Figure 5.—**An area of Kachemak silt loam, gently sloping, that has been plowed for the first time.**

Kachemak silt loam, moderately sloping (7 to 12 percent slopes) (KhC).—Except for stronger slopes, this soil is like Kachemak silt loam, gently sloping. Runoff is medium, and water erosion is a moderate hazard. The hazard of erosion is greatest during the spring thaw when the subsoil is frozen.

Included with this soil in mapping are small areas of Mutnala soils.

Most of this soil is in native vegetation, dominantly bluejoint reedgrass. Several small areas are cultivated. The main crops are hardy vegetables, potatoes, small grains, and grasses grown for hay and pasture. At high elevations and on north-facing slopes, this soil is cool in summer and is not well suited to row crops and small grains. Management group 5 (IIIe–2).

Kachemak silt loam, strongly sloping (12 to 20 percent slopes) (KhD).—This soil occupies long, smooth slopes. Runoff is medium to rapid. The hazard of water erosion is moderate to high, particularly during spring thaws or after heavy rains.

Most of this soil is in bluejoint reedgrass, but some areas are cultivated. The main crops are hardy vegetables, potatoes, small grains, and grasses grown for hay and pasture. At high elevations and on north-facing slopes, this soil is better suited to hay and pasture than to cultivated crops because the temperature is low in summer. Management group 10 (IVe–1).

Kachemak silt loam, moderately steep (20 to 30 percent slopes) (KhE).—This soil occupies hills and side slopes of valleys. The silty mantle is not so thick on this soil as on the less steep Kachemak soils. Runoff is medium to rapid, and the hazard of erosion is severe.

Most of this soil is not cultivated. It is better suited to hay and pasture than to cultivated crops. Management group 14 (VIe–1).

Kachemak silt loam, steep (30 to 45 percent slopes) (KhF).—This soil occurs on side slopes of valleys. The underlying sandy and shaly sediments outcrop on some of the steeper slopes. Runoff is rapid, and erosion is a severe hazard.

Included with this soil in mapping are a few bare escarpments and a few patches of Mutnala soils.

This soil is mostly idle, but some areas are grazed. It should be kept in permanent vegetation. Management group 18 (VIIe–1).

Killey Series

The Killey series consists of somewhat poorly drained, nearly level soils that occur on natural levees and flood plains along the lower courses of major streams and their tributaries. These soils formed in stratified silty and sandy alluvium over very gravelly material. They are most extensive at elevations of less than 200 feet. The average annual air temperature is 34° to 37° F., and the mean annual precipitation is 20 to 28 inches. The native vegetation is a sparse forest of white spruce and cottonwood trees and an understory of willows, bluejoint reedgrass, forbs, and shrubs.

The Killey soils have, on the surface, a mat of organic litter about 4 inches thick. In some places this mat includes thin lenses of silt loam deposited by recent floods. Below this are layers of mottled olive-gray and gray silt loam and fine sand. Very gravelly sand many feet thick is at a depth of 30 to 44 inches.

The Killey soils have moderate available water capacity. Permeability is moderate in the layered silt loam and sand and is moderate to rapid in the very gravelly sand. Plant roots penetrate to a depth of 20 to 30 inches. Fertility is low.

Most of the acreage of these soils is used as recreational areas and wildlife habitat, but a few small areas have been cleared and are used for cultivated crops and gardens.

The Killey soils were mapped only in an undifferentiated soil group with the Anchor Point soils.

Typical profile of a Killey silt loam, SE¼SW¼, sec. 29, T. 5 S., R. 14 W., Kenai Peninsula:

O1—2 inches to 0, mat of partly decomposed straw and plants and fragments of charcoal.

C1—0 to 1½ inches, olive-gray (5Y 4/2) silt loam; common, medium, faint mottles of brown (10YR 4/3); weak, very fine, granular structure; very friable;

many roots; very strongly acid; abrupt, smooth boundary.

O1b—1½ to 2 inches, dark reddish-brown (5YR 2/2) decomposed organic matter; very friable; many roots; very strongly acid; abrupt, smooth boundary.

IIC2b—2 to 8 inches, olive-gray (5Y 4/2) silt loam; common, medium, distinct mottles of dark brown (10YR 3/3) and brown (10YR 4/3); very weak, very thin, platy structure; very friable; many roots; thin strata of fine sand; very strongly acid; gradual, wavy boundary.

IIC3b—8 to 21 inches, olive-gray (5Y 4/2) irregularly stratified silt loam and fine sand; few, fine, faint mottles of gray (5Y 5/1) and common, medium, distinct mottles of brown (10YR 4/3) and dark yellowish brown (10YR 3/4); very weak, very thin, platy structure; very friable; common roots; very strongly acid; gradual, wavy boundary.

IIC4b—21 to 33 inches, gray (5Y 5/1) mixed with dark-brown (7.5YR 3/2) and dark yellowish-brown (10YR 3/4) silt loam; very weak, very thin, platy structure; very friable; few roots; thin irregular strata of sand; very strongly acid; abrupt, wavy boundary.

IIC5b—33 to 44 inches, dark-gray (5Y 4/1) silt loam; common, coarse, prominent mottles of dark brown (10YR 3/3 and 7.5YR 3/2) and dark reddish brown (5YR 3/3); very weak, very thin, platy structure; very friable; few roots; thin strata of fine sand; some mottles are weakly cemented; very strongly acid; abrupt, wavy boundary.

IIIC6—44 to 49 inches, dark-gray (5Y 4/1) very gravelly sand; common, coarse, distinct mottles of olive (5Y 4/3) and common, coarse, prominent mottles of dark reddish brown (5YR 3/3); single grain (structureless); loose; no roots; very strongly acid.

The Killey soils in the Homer-Ninilchik Area are grayer in the upper part of the profile than is typical for Killey soils elsewhere. The strata of silty and sandy material vary considerably in thickness, texture, and sequence.

The Killey soils are associated with the Anchor Point, Coal Creek, Moose River, Salamatof, and Slikok soils. In the Killey soils very gravelly material is at a depth of 30 to 44 inches, but very gravelly material is at a depth of 15 to 30 inches in the Anchor Point soils. The Killey soils have very gravelly sand in the lower part of the substratum, but the substratum of Coal Creek soils is firm gravelly or stony silt loam that has lenses of sand and silty clay loam. An organic layer is on the surface of the Killey soils, whereas the Salamatof soils are deep peats. The Killey soils are dominantly silt loams, but the Moose River soils are dominantly sandy and generally have a higher water table than Killey soils. The mineral horizons of Killey soils are not mucky, but the Slikok soils have mucky mineral horizons to a depth of about 30 inches.

Moose River Series

The Moose River series consists of poorly drained, nearly level soils on the flood plains of streams and in upland drainageways. These soils occur mainly along the Ninilchik River and the lower course of Deep Creek, but small areas border streams throughout the survey area. They consist of stratified sandy and gravelly material, and they have a high water table. These soils are flooded during spring thaws or during long periods of rainfall. Elevation ranges from slightly above sea level to 800 feet. The natural vegetation consists of grasses and sedges, horsetail, low-growing willows, and black spruce. A few cottonwood trees grow on natural levees and in other slightly higher areas. The mean annual precipitation is 19 to 21 inches, and the average annual air temperature ranges from 34° to 36° F.

The Moose River soils have, on the surface, a thin mat of organic material over olive-gray silt loam 2 to 5 inches thick. Below the silt loam, to a depth of 30 to 42 inches, is mottled dark-gray to dark greenish-gray stratified sand and silt loam. It is underlain by very gravelly sand.

The Moose River soils have low to moderate available water capacity. Permeability is moderate above the water table. Roots penetrate to a depth of 10 to 20 inches. Fertility is low.

Most of the acreage of these soils is idle, but a few areas can be used for grazing.

Typical profile of Moose River silt loam, NE¼SE¼, sec. 4, T. 2 S., R. 14 W., Kenai Peninsula:

O1—2 inches to 0, raw, undecomposed organic mat of leaves, twigs, and straw.

C1—0 to 3 inches, olive-gray (5Y 5/2) silt loam; common, medium, distinct mottles of very dark grayish brown (10YR 3/2); weak, very fine, crumb structure; very friable; many roots; strongly acid to medium acid; clear, smooth boundary.

C2g—3 to 15 inches, dark-gray (5Y 4/1), stratified fine sand, very fine sand, and silt loam; medium, coarse, distinct mottles of dark brown (7.5YR 3/2); weak, very thin, platy structure; very friable; roots common; medium acid; clear, wavy boundary.

C3g—15 to 24 inches, dark-gray (5Y 4/1) silt loam and thin strata of fine sand mottled with dark brown (7.5YR 3/2); weak, very thin, platy structure; very friable; few roots; medium acid; abrupt, smooth boundary.

C4g—24 to 38 inches, dark-gray (5Y 4/1) stratified silt loam and fine sand and thin lenses of coarse sand; few, coarse, prominent mottles of dark reddish brown (5YR 3/4); weak, very thin, platy structure; very friable; few roots; water table at depth of 30 inches; medium acid; abrupt, smooth boundary.

C5g—38 to 44 inches, very gravelly sand; pebbles are rounded and less than 1 inch in diameter; colors are those of individual grains; single grains; loose; medium acid; many feet deep.

The C1 horizon is commonly silt loam, but it is sandy loam in places. The layers of silt loam, sand, and gravel in the C2, C3 and C4 horizons vary considerably in arrangement and thickness. Depth to the gravelly substratum ranges from 30 to 42 inches.

The Moose River soils are associated with the somewhat poorly drained Anchor Point and Killey soils and with the poorly drained Slikok soils on flood plains. The Moose River soils are grayer and contain more sand than the Anchor Point and Killey soils. The very gravelly sand is at a greater depth in the Moose River soils than in the Anchor Point soils. The Moose River soils lack the thick, dark-colored A horizon of the Slikok soils.

Moose River silt loam (0 to 3 percent slopes) (Mo).—This nearly level soil has a water table that usually is near the surface, but late in summer it may drop to a depth of about 24 inches. Runoff is very slow to ponded. Most areas are flooded during spring thaws or after heavy rains.

This soil is mostly idle. Artificial drainage is generally not feasible. In some areas the native grasses can be grazed. Management group 16 (VIw-1).

Mutnala Series

The Mutnala series consists of well-drained, nearly level to steep soils. These soils are extensive on knolls of moraines between Anchor Point and Homer, and they are moderately extensive on wooded slopes that

border the Caribou Hills and on side slopes of the Fox River valley. Mutnala soils formed in a mantle of volcanic ash and other silty wind-laid material over gravelly glacial till. They support a forest of Sitka spruce, white spruce, and a few paper birch. Small, grassy openings in the forest are common in some places, especially on side slopes bordering the Caribou Hills. The elevation ranges from less than 100 feet to about 1,000 feet. The mean annual precipitation ranges from 24 to 28 inches, and the average annual air temperature is about 37° F.

In undisturbed areas the Mutnala soils have a thick mat of organic material, commonly moss, on the surface. Below this mat are two or three sequences of silt loam layers. Each sequence consists of a dark grayish-brown or grayish-brown layer over a very dusky red to dark-brown layer. The layers generally are 1 to 3 inches thick. Olive gravelly sandy loam is at a depth of 16 to 24 inches.

The Mutnala soils have moderate available water capacity. Permeability is moderate, and fertility is low.

These soils are forested in most places, but some areas have been cleared and are used for cultivated crops, hay, and pasture. Use for farming is limited by the isolation of many areas by surrounding muskegs.

Typical profile of Mutnala silt loam, gently sloping, SE¼SE¼, sec. 9, T. 5 S., R. 15 W., Kenai Peninsula:

O1—8 to 4 inches, raw sphagnum moss that is brown (7.5YR 5/4) when wet, pink (7.5YR 8/4) when squeezed dry; many roots; abrupt, smooth boundary.

O2—4 inches to 0, laminated sphagnum moss peat that is dark brown (7.5YR 4/4) when wet, light brown (7.5YR 6/4) when squeezed dry; thin lenses of volcanic ash near top of horizon; woody fragments; fungal mycelia at bottom of horizon; many roots; abrupt, smooth boundary.

A2—0 to ½ inch, dark grayish-brown (10YR 4/2) silt loam; thin lenses of fine sandy volcanic ash at top of horizon; thin layer of organic material near center of horizon; weak, very fine, subangular blocky structure; very friable; few roots; very strongly acid; abrupt, smooth boundary.

B2—½ to 1½ inches, dark reddish-brown (5YR 3/3) silt loam; weak, very thin, platy structure; few soft nodules; slightly brittle in place, very friable when crushed; fragments of charcoal; fungal mycelia; few roots; very strongly acid; abrupt, smooth boundary.

A2b—1½ to 3½ inches, grayish-brown (10YR 5/2) silt loam; very weak, very thin, platy structure; very friable; very thin layer of dark reddish-brown (5YR 2/2), finely divided organic matter at upper edge of horizon (probably a buried O horizon); few roots; very strongly acid; abrupt, wavy boundary.

B21b—3½ to 4 inches, very dusky red (2.5YR 2/2) silt loam; weak, very fine, granular structure; very friable; releases water and becomes smeary when rubbed; fragments of charcoal; fungal mycelia; few roots; very strongly acid; abrupt, broken boundary.

B22b—4 to 5½ inches, dark reddish-brown (2.5YR 2/4) silt loam; few, fine, dark reddish-brown concretions; weak, very fine, granular structure; smeary when rubbed; few roots; very strongly acid; abrupt, wavy boundary.

B3b—5½ to 9½ inches, dark-brown (7.5YR 4/4) silt loam; patches and streaks of very dark brown, dark grayish brown, and brown; weak, very thin, platy structure; smeary when rubbed; few roots; very strongly acid; abrupt, wavy boundary.

A'1b—9½ to 12 inches, very dark brown (10YR 2/2) silt loam; patches of dark brown (7.5YR 3/2); weak, very thin, platy structure; fluffy, smeary when rubbed; few roots; very strongly acid; abrupt, wavy boundary, but horizon is broken in places.

B'2b—12 to 16 inches, dark-brown (7.5YR 4/4) silt loam; weak, very fine, granular structure; smeary when rubbed; few pebbles; few roots; very strongly acid; clear, wavy boundary.

B'3b—16 to 22 inches, dark yellowish-brown (10YR 4/4) silt loam; massive; smeary when rubbed; few pebbles; many fine pores; few roots; very strongly acid; abrupt, wavy boundary.

IIC—22 to 30 inches +, olive (5Y 4/3) gravelly sandy loam; patches of olive brown (2.5Y 4/4); thick platy structure that breaks to weak, fine, subangular blocky structure; friable; no roots; very strongly acid.

Frost mounds as much as 18 inches high are common on the surface and, in some places within these mounds, the horizons are distorted or even overturned. In places the upper part of the B horizon is weakly cemented. Depth to the IIC horizon ranges from 12 to 24 inches. As much as 50 percent of the soil mass in the IIC horizon is gravel and cobblestones as much as 6 inches in diameter. In some places this horizon contains strata of sandy loam and silt loam.

The Mutnala soils are associated with the well-drained Kachemak soils on the higher hills and with the very poorly drained Salamatof soils on muskegs. The sequence of horizons that is characteristic of the Mutnala soils is lacking in the Kachemak soils. An organic layer is on the surface of the Mutnala soils, whereas the Salamatof soils are deep, fibrous peats.

Mutnala silt loam, nearly level (0 to 3 percent slopes) (MuA).—This soil commonly occupies the tops of knobs and ridges of moraines. Runoff is very slow, and the hazards of water erosion and soil blowing are not more than slight.

This soil is mostly idle, but small areas have been cleared and cultivated. Suitable crops are hardy vegetables, potatoes, oats, barley, and grasses grown for hay and pasture. Management group 6 (IIIs–1).

Mutnala silt loam, gently sloping (3 to 7 percent slopes) (MuB).—This soil is in a few large tracts. Most areas are undulating and have short escarpments. Runoff is slow, and the hazard of water erosion is slight. The profile of this soil is the one described as typical for the series (fig. 6).

Included with this soil in mapping are small areas of Spenard and Salamatof soils.

Most of this soil is wooded, but some areas have been cleared and cultivated. Suitable crops are hardy vegetables, potatoes, small grains, and grasses grown for pasture and hay. Management group 4 (IIIe–1).

Mutnala silt loam, moderately sloping (7 to 12 percent slopes) (MuC).—This soil occurs mainly on knobs of moraines, but the slopes are long and uniform in places. Surface runoff is slow to medium, and erosion is a slight to moderate hazard.

Included with this soil in mapping, in depressions between knobs of moraines, are patches of Salamatof peat.

A few areas of this soil have been cleared and are used for hardy vegetables, potatoes, small grains, and grasses grown for pasture and hay. Management group 4 (IIIe–1).

Mutnala silt loam, strongly sloping (12 to 20 percent slopes) (MuD).—This soil occupies slopes of valleys and knobs of moraines. Runoff is medium, and the hazard of water erosion is moderate.

Figure 6.—**Profile of Mutnala silt loam, gently sloping.**

Included with this soil in mapping are a few areas of Mutnala soils that have slopes of more than 20 percent, and a few areas of Salamatof peat.

This soil is suited to improved pasture and to hay crops, and it can be used for an occasional cultivated crop. Management group 10 (IVe–1).

Mutnala silt loam, moderately steep (20 to 30 percent slopes) (MuE).—This soil is mainly in large areas on valley slopes. Generally, it has a thinner silty mantle than the less sloping Mutnala soils. Runoff is medium to rapid, and the hazard of erosion is moderate to severe.

Included with this soil in mapping are small areas of Bernice and Grewingk soils.

This soil is mostly woodland. It is suited to permanent pasture, but it is better to leave most areas in trees. Management group 14 (VIe–1).

Mutnala silt loam, steep (30 to 45 percent slopes) (MuF).—Except that slopes are steeper, this soil is similar to Mutnala silt loam, moderately steep. If this soil were cleared, runoff would be rapid and the hazard of water erosion severe.

Included with this soil in mapping are areas of Bernice and Grewingk soils.

This soil is better suited to trees than to other uses. Management group 18 (VIIe–1).

Nikolai Series

The Nikolai series consists of poorly drained, nearly level soils that occur in the northern part of the survey area in upland depressions near the coast. The native vegetation is tall grasses, dominantly bluejoint reedgrass. The elevation ranges from 50 to 150 feet. The mean annual precipitation is 19 to 21 inches, and the average annual air temperature is 34° to 36° F.

The Nikolai soils have about 3 to 6 inches of partly decomposed organic material over a black and dark reddish-brown mucky silt loam surface layer that typically is about 10 inches thick. Below this is pale-brown silt loam and dark-brown mucky silt loam having thin layers of volcanic ash. The next layer is black, finely divided peat and lenses of silt loam. It is underlain by greenish-gray silt loam that extends to a depth of 30 to 40 inches.

The Nikolai soils have high available water capacity. Permeability is moderate. Roots penetrate to a depth of 20 to 30 inches, and fertility is low.

These soils are mostly in native grasses, but some areas have been drained and are used for crops and pasture.

Typical profile of Nikolai silt loam, SW¼SW¼, sec. 34, T. 1 S., R. 14 W., Kenai Peninsula:

O1—4 inches to 0, mat of partly decomposed grass and other plants.

A11—0 to 5 inches, black (5YR 2/1) mucky silt loam; weak, very fine, granular structure; smeary when rubbed; many roots; very strongly acid; abrupt, wavy boundary.

A12—5 to 10 inches, dark reddish-brown (5YR 3/3) mucky silt loam; patches of pale brown (10YR 6/3); weak, very fine, subangular blocky structure; smeary when rubbed; common roots; very strongly acid; abrupt, irregular boundary.

C1—10 to 14 inches, pale-brown (10YR 6/3) silt loam; streaks of brown (7.5YR 4/4); weak, fine, angular blocky structure; smeary when rubbed; common roots; horizon is discontinuous in places; very strongly acid; abrupt, broken boundary.

Ab—14 to 22 inches, dark-brown (7.5YR 3/2) mucky silt loam; thin lenses of pale brown (10YR 6/3) volcanic ash of silt loam and very fine sand texture; moderate, thin, platy structure; smeary when rubbed; common roots; very strongly acid; abrupt, smooth boundary.

Ob—22 to 31 inches, black (5YR 2/1), finely divided peat and lenses of silt loam, probably volcanic ash; mod-

erate, fine, platy structure; common roots; very strongly acid; abrupt, smooth boundary.

IIC2—31 to 40 inches, greenish-gray (5GY 5/1) silt loam; common, medium, prominent mottles of light olive brown (2.5Y 5/4); massive; moderately firm; very strongly acid; few roots in upper part of horizon; fine vesicles.

The horizons of silty material in the upper part of the profile distinguish the Nikolai soils in this survey area from soils in the Nikolai series elsewhere.

Pockets and layers of volcanic ash commonly occur throughout the profile. Depth to the IIC2 horizon ranges from 30 to 48 inches. The horizons of peat vary considerably in thickness and sequence.

The Nikolai soils are associated with the well-drained Cohoe and Island soils. Unlike the Cohoe and Island soils the Nikolai soils contain layers of peat.

Nikolai silt loam (0 to 3 percent slopes) (Nl).—This soil is nearly level and poorly drained. Runoff is very slow or ponded. Artificial drainage is needed if this soil is used for cultivated crops.

Most of the acreage of this soil is in native vegetation, mainly tall bluejoint reedgrass. Some areas have been drained, and cultivated crops have been grown successfully in these areas. The common crops are hardy vegetables, potatoes, oats, barley, and grasses grown for hay and pasture. Management group 7 (IIIw-1).

Rough Broken Land

Rough broken land (Ro) consists of escarpments that border the Caribou Hills, of cliffs along the coast, and of deep canyons of creeks that flow into Kachemak Bay. All areas have a high rate of geological erosion, and seams of coal are exposed in some places. Many of the adjacent areas below are covered by silt, gravel, and shale fragments that have been dislodged from the escarpments. Some areas are bare, but scattered thickets of alder and devilsclub are common in most areas. Management group 22 (VIIIs-1).

Salamatof Series

The Salamatof series consists of deep, very poorly drained, nearly level peat soils. These soils occur in muskegs that range from a few acres to several thousand acres in size. They developed from accumulated coarse moss peat, dominantly from sphagnum moss but also from sedges. The living vegetation on this soil includes sphagnum moss, sedges, dwarf birch, cloudberry, lingenberry, Labrador-tea, and scattered black spruce. Some areas, especially those near the edges of muskegs, are covered with black spruce. Salamatof soils are most common at elevations of less than 800 feet, but small areas occur at higher elevations. The mean annual precipitation ranges from 19 inches in the northern part of the survey area to 24 inches in the southern part. The average annual air temperature is 34° to about 37° F.

The Salamatof soils have a mat of relatively undecomposed sphagnum moss on the surface. Below the moss, to a depth of 60 inches to many feet, are layers of moss peat that alternate with layers of sedge peat. The underlying material is silt loam or silty clay loam.

The Salamatof soils are high in available water capacity. Permeability is moderate.

These soils are used mainly as wildlife habitat.

Typical profile of Salamatof peat, NW¼NW¼, sec. 11, T. 5 S., R. 15 W., Kenai Peninsula:

Oi1—0 to 4 inches, mat of raw sphagnum moss and roots that are dark brown (7.5 YR 3/2) when wet, brown (7.5YR 5/4) when squeezed dry; extremely acid; gradual boundary.

Oi2—4 to 10 inches, coarse moss peat and layers of sedge peat that are dark brown (10YR 3/2) when wet, dark yellowish brown (10YR 4/4) when squeezed dry; few woody fragments; extremely acid; gradual boundary.

Oi3—10 to 42 inches, coarse moss peat and layers of sedge peat that are dark brown (10YR 3/2) when wet, dark yellowish brown (10YR 3/4) when squeezed dry; thin lenses of sandy volcanic ash; extremely acid; many feet thick.

The peat ranges from 60 inches to many feet in thickness. In places layers of finely divided peat occur, and in forested areas woody materials are present in some places. Thin lenses of sand-size volcanic ash occur in the profile in areas south of Ninilchik.

The Salamatof soils are associated with the well-drained Cohoe and Mutnala soils of adjoining uplands and with the somewhat poorly drained Spenard soils on muskeg borders. The Salamatof soils formed in organic materials, but the Cohoe, Mutnala, and Spenard soils did not.

Salamatof peat (Sa).—In this very poorly drained soil, the water table is always near the surface. This soil is commonly ponded. Erosion is not a hazard.

Included with this soil in mapping, near muskeg borders, are patches of Doroshin soils and a few areas of Slikok mucky silt loam bordering streams.

Salamatof peat is chiefly used as wildlife habitat. It cannot be drained so that it can be cultivated, but areas that are not wooded are suitable for limited grazing. Management group 21 (VIIw-2).

Slikok Series

In the Slikok series are dark-colored, poorly drained, nearly level to gently sloping soils that occur throughout the survey area on flood plains, in upland drainageways, and on slopes subject to seepage. The native vegetation is mainly willows, tall grasses, and scattered black spruce. Many areas are covered with tussocks of grass. The elevation of these soils ranges from 25 to about 1,000 feet. The average annual air temperature is 34° to 37° F., and the mean annual precipitation is 19 to 24 inches.

The Slikok soils have a mat of organic material, 6 to 15 inches thick, that overlies a layer of black, mucky silt loam 6 to 18 inches thick. Below this silt loam, to a depth of more than 48 inches, is very dark gray to dark reddish-brown silt loam that contains lenses of fine sand and peat in some places.

The Slikok soils have high available water capacity and are moderately permeable. Fertility is low.

Most of the acreage of these soils is used as wildlife habitat, but drained areas are suited to cultivated crops, hay, and pasture.

Typical profile of Slikok mucky silt loam, nearly level, SW¼SE¼, sec. 20, T. 2 S., R. 14 W., Kenai Peninsula:

O11—10 to 5 inches, brown (7.5YR 5/4) mat of raw sphagnum moss; many roots; very strongly acid; abrupt, smooth boundary.

O12—5 inches to 0, dark reddish-brown (5YR 2/2), partly decomposed organic material; many roots; very strongly acid; clear, smooth boundary.

A1—0 to 15 inches, black (5YR 2/1) mucky silt loam; weak, fine, granular structure; very friable; many roots; thin discontinuous lenses of volcanic ash and lenses of peat; very strongly acid; clear, wavy boundary.

C—15 to 30 inches, dark-gray (5Y 4/1) mucky silt loam; massive; friable; fine pores and vesicles; very strongly acid.

The A1 horizon ranges from 6 to 18 inches in thickness. In some places a horizon of stony material occurs below a depth of 12 inches. Particles of wood and other organic material are buried in the uppermost 16 inches of the soil. In places the C horizon is stratified with silty and sandy material.

The Slikok soils are associated with the somewhat poorly drained Anchor Point and Killey soils and with the poorly drained Salamatof soils. Unlike the uppermost mineral layer of the Anchor Point and Killey soils, the corresponding layer in the Slikok soils is mucky and contains lenses of peat. An organic layer is on the surface of the Slikok soils, whereas the Salamatof soils are deep peats.

Slikok mucky silt loam, nearly level (0 to 3 percent slopes) (SkA).—This soil is on flood plains along secondary streams. The water table is near the surface much of the time. Runoff is very slow to ponded. This soil has the profile described as typical for the series.

The principal use of this soil is wildlife habitat, but a few areas are used for unimproved pasture. Where drained, this soil is suited to hardy vegetables and to grasses grown for pasture and hay. Management group 13 (IVw-3).

Slikok mucky silt loam, gently sloping (3 to 7 percent slopes) (SkB).—This soil commonly occupies upland drainageways and the borders of muskegs. It is almost as wet as the nearly level Slikok mucky silt loam, but it can be drained more easily than that soil if drainage outlets are available. Runoff is very slow.

Included with this soil in mapping are small areas of Spenard silt loam and of Salamatof peat.

The principal use for this soil is wildlife habitat, but a few areas are used for unimproved pasture. Where drained, this soil is suited to hardy vegetables and to grasses and legumes grown for hay and pasture. Management group 13 (IVw-3).

Spenard Series

The Spenard series consists of somewhat poorly drained, nearly level to moderately sloping soils that border muskegs and lakes and occur in seep areas. These soils formed in a mantle of silty material that, at depths of about 30 inches, is underlain by medium-textured glacial till or lacustrine deposits. The native vegetation is a mixed forest of white spruce, black spruce, and paper birch and an understory of willows, grasses, and horsetail. The elevation ranges from 50 to 800 feet. The mean annual precipitation is 19 to 24 inches, and the average annual air temperature is 34° to 37° F.

Where the Spenard soils are undisturbed, 4 to 8 inches of partly decomposed organic material covers the surface. Below the organic material is a layer of mottled very dark grayish-brown silt loam 1 to 6 inches thick. The subsoil consists of dark-brown or dark reddish-brown silt loam 8 to 12 inches thick over a layer of mottled brown silt loam that varies in thickness. The underlying material is olive silt loam at a depth of 18 to 36 inches. Below that is mottled, firm silt loam or silty clay loam that is gravelly in some places.

The Spenard soils have moderate to high available water capacity. Permeability is moderate, and the water table is moderately high. Roots penetrate to a depth of 12 to 16 inches, and fertility is low.

Most areas are in forest. Where cleared and drained, these soils are suited to crops, hay, and pasture.

Typical profile of Spenard silt loam, nearly level, NW¼SE¼, sec. 34, T. 4 S., R. 13 W., Kenai Peninsula:

O11—7 to 4 inches, raw sphagnum moss and hypnum moss.

O12—4 inches to 0, dark reddish-brown (5YR 2/2) mat of partly decomposed organic matter and many roots over a thin layer of volcanic ash; abrupt, smooth boundary.

A1—0 to 5 inches, very dark grayish brown (2.5Y 3/2) silt loam; common, medium, distinct mottles of brown (10YR 4/3); massive; friable; roots common; black streak near center of horizon; very strongly acid; clear, wavy boundary.

B2—5 to 10 inches, dark-brown (7.5YR 3/2) silt loam; streaks and patches of dark reddish brown (5YR 3/3); massive; friable; few roots; few fine concretions; many pores; very strongly acid; clear, wavy boundary.

B22—10 to 16 inches, mixed brown and dark-brown (10YR 4/3 and 7.5YR 4/4) silt loam; massive; friable when moist, nonsticky and nonplastic when wet; few roots; few very fine concretions; many pores; very strongly acid; clear, smooth boundary.

B23—16 to 26 inches, brown (10YR 4/3) silt loam; many, coarse, faint mottles of dark yellowish brown (10YR 4/4) and dark reddish brown (5YR 3/2); weak, very thin, platy structure; friable when moist, nonsticky and nonplastic when wet; very strongly acid; clear, smooth boundary.

C1—26 to 31 inches, olive (5Y 5/3) silt loam; massive; friable; very strongly acid; abrupt, smooth boundary.

IIC2 -31 to 40 inches, olive (5Y 5/3) silt loam; common, coarse, distinct mottles of dark reddish brown (5YR 3/4); massive; firm; few soft concretions; very strongly acid.

The A1 horizon ranges from 1 to 6 inches in thickness. The B horizon is brown and dark brown to dark reddish brown. Depth to the IIC2 horizon ranges from 18 to 36 inches. The C horizon generally is silt loam, but it is silty clay loam in some places. The C horizon contains as much as 30 percent pebbles by volume. The dark-brown subsoil and less clayey underlying material distinguish the Spenard soils in this survey area from those elsewhere.

The Spenard soils are associated with the well-drained Cohoe and Mutnala soils on uplands and with the very poorly drained Salamatof soils. The Spenard soils are mottled and have other characteristics of wetness that are lacking in the Cohoe and Mutnala soils. An organic layer is on the surface of the Spenard soils, whereas the Salamatof soils are deep peats.

Spenard silt loam, nearly level (0 to 3 percent slopes) (SpA).—This soil is commonly on the borders of muskegs. It has the profile described as typical for the series. The water table generally is within 1 or 2 feet of the surface. Runoff is very slow to slow, and the hazard of erosion is slight to none.

Included with this soil in mapping are small areas of the well-drained Cohoe soils and of the poorly drained Salamatof soils.

This Spenard soil is mostly woodland. It is difficult to drain because of its low position. Where drained, this soil is suited to grasses and legumes grown for hay and pasture. Management group 13 (IVw-3).

Spenard silt loam, gently sloping (3 to 7 percent slopes) (SpB).—This soil is similar to Spenard silt loam, nearly level, but has stronger slopes and is easier to drain. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are spots of Cohoe and Mutnala soils.

Most of this soil is woodland. Where cleared and drained, it is suited to hardy vegetables and to grasses and legumes grown for hay and pasture. Management group 13 (IVw-3).

Spenard silt loam, moderately sloping (7 to 12 percent slopes) (SpC).—This soil is generally on short escarpments and slopes below broad, wet areas on uplands. Except for the slope, it is similar to Spenard silt loam, nearly level. In drained and cleared areas runoff is slow to medium, and erosion is a slight to moderate hazard.

Included with this soil in mapping are small areas of Cohoe and Mutnala soils.

Where cleared and drained, this soil is suited to hardy vegetables and to grasses and legumes grown for hay and pasture. Management group 9 (IIIw-3).

Starichkof Series

The Starichkof series consists of deep, very poorly drained, nearly level to gently sloping soils that occur in large muskegs in the Caribou Hills and in small areas throughout the survey area. The native vegetation is mainly a thick cover of sedges and varying amounts of sphagnum moss and hypnum moss. Black spruce grows along the borders of most of the muskegs. These soils are most extensive at elevations of 800 to 2,000 feet, but a few patches are at lower elevations. The average annual air temperature is 34° to 37° F., and the mean annual precipitation is 19 to 28 inches.

The Starichkof soils consist of finely divided sedge peat and thin lenses of volcanic ash. The layers of peat are more than 48 inches thick.

The Starichkof soils have high available water capacity. The water table normally is near or at the surface. Permeability is moderate.

These soils are not suitable for farming.

Typical profile of Starichkof peat, nearly level, NE¼NW¼, sec. 13, T. 5 S., R. 12 W., Kenai Peninsula:

Oi1—0 to 7 inches, raw sedge peat that is dark reddish brown (5YR 2/2) when moist, and (5YR 3/2) when squeezed dry, many roots; very strongly acid; abrupt, smooth boundary.

C1—7 to 9 inches, volcanic ash consisting of dark grayish-brown (2.5Y 3/2) silt loam; weak, very thin, platy structure; very friable; many roots; very strongly acid; abrupt, smooth boundary.

Oe1—9 to 42 inches, very dark brown (10YR 2/2), finely divided laminated sedge peat; thin discontinuous lenses of sandy and silty volcanic ash; very strongly acid.

The profile contains thin layers of coarse moss peat in some places. The layers of volcanic ash range from less than 1 inch to 6 inches in thickness.

The Starichkof soils are associated with the well-drained Kachemak and Mutnala soils on uplands. The Starichkof soils are deep peats in contrast to the Kachemak and Mutnala soils that are mostly mineral material.

Starichkof peat, nearly level (0 to 3 percent slopes) (SrA).—This soil is common in muskegs of the Caribou Hills. It has the profile described as typical for the series. The native vegetation is sedges, Labrador-tea, dwarf birch, low-growing shrubs, and some sphagnum moss. Black spruce grows on the borders of most muskegs.

Included with this soil in mapping are small areas of soils that have short, steep slopes and that separate different levels within the muskegs.

This soil is not suited to cultivated crops and is very difficult to drain. Management group 21 (VIIw-2).

Starichkof peat, gently sloping (3 to 7 percent slopes) (SrB).—This soil is not so wet as Starichkof peat, nearly level. The native vegetation is mainly a forest of black spruce or a mixed forest of Sitka spruce, black spruce, paper birch, and alder. Sedges and other low-growing plants grow in open areas.

Although this soil is not as difficult to drain as Starichkof peat, nearly level, the cost to drain it is prohibitive. Management group 21 (VIIw-2).

Tidal Flats

Tidal flats (Ta) occur in a few small areas; the largest area is below Beluga Lake at Homer. The flats consist of layered sandy, silty, and clayey deposits. They are flooded almost every day by high tides, and they are barren. Tidal flats are not suited to cultivated crops or pasture. Management group 23 (VIIIw-1).

Tidal Marsh

Tidal marsh (Tm) occupies areas above Tidal flats and is next to Tidal flats on the land side. It generally occurs at the mouth of major streams. A large area is at the mouth of the Fox River Valley. Tidal marsh is flooded occasionally by fresh-water streams and by high tides.

In some places the soil material is sandy; layers of sandy material may occur at any depth in the fine-textured material. The water table is always at or near the surface. Because the ground water has a high content of minerals, Tidal marsh is nearly neutral in reaction.

Areas of Tidal marsh have a cover of sedges, horsetail, beach wild-rye, and other plants that commonly grow in meadows near the coast. The native vegetation is grazed in some areas. Management group 17 (VIw-2).

Use and Management of Soils

This section contains information on the use and management of soils in the Homer-Ninilchik Area for crops and pasture, for wildlife, and in engineering.

It also contains information about the native vegetation in the survey area.

In presenting information about the use of soils for crops and pasture, the procedure is to describe a group of similar soils that are suitable for those purposes and to suggest use and management for the group. To determine the soils in each group, refer to the "Guide to Mapping Units" at the back of this survey. In the subsection "Native Vegetation" the vegetation common to the six soil associations in this survey area is discussed. The wildlife in the soil associations is discussed in the subsection "Wildlife." In the subsection on engineering, the soils are not grouped but are placed in tables so that properties significant to engineering work can be given readily.

Crops and Pasture

Most of the Homer-Ninilchik Area consists of silt loam soils. Cultivated crops can be grown on about 45 percent of the acreage in the survey area, though not year after year in all places, but most of the acreage has not been cleared and cultivated. The principal crops include hardy vegetables, potatoes, small grains, and legumes and grasses grown for hay and pasture. Peat and poorly drained soils occupy a large acreage, and most of these areas are difficult to drain. They generally are not suited to cultivated crops but can be grazed in some places.

This subsection discusses land clearing, fertilizer needs, and yields of suitable crops and pasture. Then the system of capability classification used by the Soil Conservation Service is described, and suggested management by groups of soils, or capability units, is given.

Land clearing

The well-drained soils can be cleared at any time of the year after the merchantable timber has been harvested, but clearing is most efficient when the soils are not frozen. The trees and shrubs left after logging can be pushed over by a bulldozer equipped with a scarifier blade. These trees and shrubs, together with large roots, are then pushed into windrows by the scarifier blade. In sloping areas the windrows should be diagonal to the slope in order to keep runoff from ponding on the upper sides and, at the same time, to control runoff from the newly cleared fields. Natural drainageways should not be blocked by the windrows. When the trees, shrubs, and roots in the windrows are dry, generally about a year after clearing, they should be burned. Several burnings generally are necessary to completely destroy the windrows.

When the soil is frozen, the trees can be sheared by a bulldozer and piled in windrows without disturbing the soil. Later in spring or in summer, the stumps and large roots can be moved to the windrows by a scarifier blade fitted to the bulldozer. In clearing the land it is important to leave as much of the forest litter on the soil as possible so that it can be mixed with the mineral soil. The organic matter is effective in maintaining good tilth and in promoting rapid infiltration of water.

Many of the grass-covered soils are hummocky. They can be prepared for cultivated crops by breaking them with a heavy plow or disc and then harrowing several times. On fields that are not hummocky, rototilling can be used instead of breaking and harrowing. The soil should be moist, but not wet, during these operations.

The somewhat poorly drained and poorly drained soils can be cleared most easily when the soil is frozen. Drainage ditches are needed in many fields before the roots and stumps are removed and before breaking and harrowing the grassy areas.

Oats and peas grown for hay or silage are suitable as first crops on newly cleared or prepared soils. These crops can be followed by bromegrass, or potatoes, and other vegetables.

Fertilizer requirements

Most of the soils in the Homer-Ninilchik Area, including dark-colored soils that developed under grass, are not naturally fertile. Climatically adapted crops, however, grow well on most of the well drained soils if they are properly fertilized and otherwise well managed.

Heavy applications of a fertilizer that contains nitrogen, phosphorus, and potassium are needed on the newly cleared or prepared soils in the survey area. These soils need large amounts of nitrogen because much of this element is used by bacteria in decomposing the native organic material. Large amounts of phosphorus are also needed because much of the phosphorus is held tightly by the clay in the soils and is not available to plants. Applications of lime are beneficial on these acid soils. Fertilizer must be applied to each crop each year if crop growth is to be good. The amount of fertilizer required varies according to the needs of the crop and the fertility of the soil. Soils should be tested frequently to determine the fertilizer needs.

Continuous cultivation tends to break down the natural structure of the soil, particularly on soils that were wooded but have had most of the organic material removed during clearing. Soils of this kind require periodic additions of manure or other organic matter to help maintain tilth.

The needs for fertilizer are about the same for the somewhat poorly drained and poorly drained soils in the survey area as for the well-drained soils. Few of these soils are suited to crops without artificial drainage or protection from seepage by diversion ditches. The very poorly drained peat soils in the survey area are not suited to crops.

Yields of suitable crops and pasture

Only general information on the yields of crops is available in the Homer-Ninilchik Area, because the areas that have been cleared and used for farming are relatively small. If adequately fertilized, the well-drained soils and the somewhat poorly drained and poorly drained soils that have been artificially drained yield per acre about 10 tons of potatoes, 2½ tons of bromegrass hay, 2 tons of oat-pea hay, and about 7 tons of grass or oat-pea silage. In addition to potatoes, the garden vegetables that have been successfully grown in the survey area, and the acre yields obtained, are cabbage, 8 tons; carrots, 5 tons; squash, 3 tons; lettuce, 7 tons; beets, 4 tons; cauliflower, 6 tons; and broccoli,

4 tons. Onions, garden peas, radishes, and turnips are also grown. Tomatoes can be grown successfully only in greenhouses, and corn is not suited to the soils in the survey area.

The native grasses and associated forbs in the survey area provide good hay, silage, and pasture. Bluejoint reedgrass *(Calamagrostis canadensis)* is the dominant native grass. The degree of maturity determines the quality of the forage, which decreases rapidly after the grass has fully headed. If bluejoint reedgrass is used for hay or silage, it should be cut between the boot stage and the fully headed stage, which normally occurs late in July before the rainy season begins. Expected average yields of hay are about 1 ton per acre. If the native grasses are harvested more than once a year, they are replaced by less desirable invader plants. The native grasses are not likely to respond to additions of fertilizer where the soils are covered by a mat of undecomposed plant debris. Experiments have shown, however, that the response to fertilizer is good where the organic mat has been removed *(7)*.

The quality and the quantity of forage and pasture can be improved by leveling the grass tussocks, which impede the use of machinery, and then applying a complete fertilizer. If bluejoint reedgrass is overgrazed, the less desirable forbs and annual grasses become dominant. Overseeding the pasture with more tolerant and palatable plants keep the pasture from deteriorating. Suitable grasses for overseeding include smooth bromegrass *(Bromus inermis)*, reed canarygrass *(Phalaris arundinacea)*, bluegrass *(Poa spp.)*, meadow foxtail *(Alopecurus pratensis)*, orchardgrass *(Dactylis glomerata)*, white clover *(Trifolium repens)*, and alsike clover *(Trifolium hybridum)*. A climatically adapted variety of red clover has been developed by the Alaska Agricultural Experiment Station, but a suitable variety of alfalfa is not yet available.

Controlled grazing is the only practical management practice in the many areas that are inaccessible to vehicles because they are surrounded by muskegs, lack roads or trails, or are steep and hilly.

Small grains have not been grown successfully in the past in this survey area, but recent experiments indicate that it may be feasible to grow winter rye and winter wheat. It is possible to mature barley at the lower elevations in the survey area, but the harvested grain commonly needs artificial drying for safe storage.

Small fruits native to the survey area include lingenberries, (lowbush cranberries), mooseberries (highbush cranberries), raspberries, currants, blueberries, and rose hips; some of these are used for jams and jellies for commercial use. Strawberries are grown also, mostly in home gardens. Except for Siberian crabapple, fruit trees have not survived in the survey area.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forest trees, or for engineering.

In the capability system all kinds of soils are grouped at three levels, the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. Classes are defined as follows:

- Class I soils have few limitations that restrict their use. (None in the Homer-Ninilchik Area.)
- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, woodland, or wildlife. (None in the Homer- Ninilchik Area.)
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.
- Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife.
- Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in Class V are subject to little or no erosion, though they have other limitations that restrict

their use largely to pasture, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIs–1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the subsection "Management of Groups of Soils" the capability class and subclass for each of the management groups is given in parentheses after the group number, and the groups in each subclass are numbered. The capability class and subclass are tentative until further studies are made on the limitations of the climate on cultivated crops in this survey area.

Management of groups of soils

The soils in the Homer-Ninilchik Area have been placed in management groups. The soils in each group have about the same limitations, are subject to similar risks of damage, need about the same kind of management, and respond to management in about the same way.

In the following pages each management group is described briefly and management of each is discussed. The names of the soil series represented are given in the description of each management group, but this does not mean that all of the soils in a given series are in the group. To determine the soils in each management group, refer to the "Guide to Mapping Units" at the back of this survey. Also, the management group assigned to any soil is listed at the end of the description of that soil in the section "Descriptions of the Soils."

The descriptions of the management groups also point out soil features that limit the use of soils for crops or pasture. Only general recommendations are given for overcoming the limitations. For more specific information regarding farming in this survey area, the reader should contact the Alaska Agricultural Experiment Station, the local Extension Agent, or the local Soil Conservation Subdistrict.

MANAGEMENT GROUP 1 (IIe–1)

This group consists of gently sloping, well-drained soils in the Cohoe and Island series. These soils have a silt loam surface layer and are strongly acid to very strongly acid in the upper part. Permeability and available water capacity are moderate, and the availability of plant nutrients is low.

Erosion is a slight hazard, but gullies may form on long, unprotected slopes. Runoff and erosion can be controlled by contour cultivation or similar practices. In coastal areas where strong winds are common, planting trees in windbreaks and stripcropping with grass are needed to control soil blowing.

Crops respond to good management that includes the use of fertilizers. By growing grass crops and adding organic matter, tilth and seedbeds are improved, infiltration of water is increased, and runoff and erosion are reduced.

MANAGEMENT GROUP 2 (IIc–1)

This group consists of nearly level, well-drained soils in the Cohoe and Island series. These soils have a silt loam surface layer and are very strongly acid and strongly acid in the upper part. Permeability and available water capacity are moderate, and the content of plant nutrients is low. These soils have slower surface drainage and are somewhat slower to warm and dry for spring planting than the soils in group 1.

Erosion is a slight hazard, except in coastal areas where strong winds blow. Soil blowing can be controlled by planting or leaving trees in strips about 100 feet wide and 1/8 mile apart.

These soils are well suited to all crops grown in the survey area. Tilth can be maintained or improved by growing grass crops in rotation and by adding organic matter regularly to the soil.

MANAGEMENT GROUP 3 (IIw–1)

Beluga silt loam, gently sloping, is the only soil in this group. This wet soil is subject to seepage from higher areas. It can be drained by installing a system of deep interceptor ditches and field ditches that reach the firm underlying material. This soil is medium acid. Crops respond well to good management that includes additions of fertilizer. Erosion is only a slight hazard, but contour tillage and other practices of erosion control are needed. If it is drained, this soil is well suited to vegetables and grasses.

MANAGEMENT GROUP 4 (IIIe–1)

This group consists of gently sloping and moderately sloping, well-drained soils in the Cohoe, Island, and Mutnala series. These soils have silt loam texture, and they are shallow to deep over gravelly material.

The soils in this group are strongly acid and are low in availability of plant nutrients. Permeability and available water capacity are moderate.

In areas near the coast, windbreaks are needed to protect the soils against soil blowing. Contour tillage, which is necessary at all times, and other practices, such as stripcropping, help to control erosion. Good tilth can be maintained and runoff reduced by making grass crops a part of the rotation.

MANAGEMENT GROUP 5 (IIIe–2)

This group consists of gently sloping and moderately sloping, well-drained soils in the Kachemak series. These soils have a silt loam surface layer and are very strongly acid throughout. Permeability and available water capacity are moderate, and the availability of plant nutrients is low.

These soils occur at elevations of more than 800 feet. They are slow to thaw in spring. Planting dates are later and the growing season is shorter than at lower elevations.

Contour cultivation and stripcropping are needed to control erosion. Growing grass crops in regular rotation improves tilth and controls runoff. Soils at elevations of more than 1,200 to 1,400 feet are shallow over gravelly material. They are not well suited to cultivated crops because of the late thaw and low soil temperatures. Soils at higher elevations are well suited to summer grazing.

MANAGEMENT GROUP 6 (IIs-1)

Mutnala silt loam, nearly level, is the only soil in this group. This soil is shallow to gravelly material, well drained, and very strongly acid. The fertility is low, the available water capacity is moderate, and the erosion hazard is slight. If the soil is adequately fertilized, most crops suited to the climate can be grown.

MANAGEMENT GROUP 7 (IIIw-1)

Nikolai silt loam, the only soil in this group, has a mucky surface layer, a peaty subsoil, and a silty substratum. This soil is poorly drained to somewhat poorly drained, very strongly acid, and low in plant nutrients. It has a permanent water table that drops to a depth of about 4 feet below the surface in midsummer.

This soil occurs in low areas under short escarpments. Erosion is not a hazard.

Artificial drainage is required if this soil is to be cultivated. Although slow to warm in spring, this soil is well suited to vegetables, grain, and hay crops if it is managed well.

MANAGEMENT GROUP 8 (IIIw-2)

Beluga silt loam, nearly level, is the only soil in this group. Permeability is moderate in the upper layers and is moderately slow below. The soil is poorly drained, and runoff is slow. Some areas are ponded occasionally, and some areas in the Fox River Valley are subject to occasional flooding. Erosion from runoff is not a hazard.

This soil is slow to thaw in spring and is difficult to drain, but it is well suited to vegetables where it is drained. Tilth can be maintained by leaving crop residues or spreading manure on the soil.

MANAGEMENT GROUP 9 (IIIw-3)

This group consists of moderately sloping, somewhat poorly drained to poorly drained soils in the Beluga, Coal Creek, and Spenard series. These soils have a silt loam surface layer. Permeability is moderate in the upper layers and is moderate to moderately slow below.

Artificial drainage is required if these soils are cultivated. The Beluga soils are better suited to farming than the other soils in this group because they occur in larger tracts and crops grow better if management is good. Spenard soils occur in patches, mostly adjacent to muskegs, and Coal Creek soils occur mainly in long narrow strips at moderately high elevations. The advantage of draining the small areas is doubtful. Contour plowing and stripcropping are needed to control erosion caused by heavy rains and melting snow.

MANAGEMENT GROUP 10 (IVe-1)

This group consists of strongly sloping, well-drained soils in the Cohoe, Island, Kachemak, and Mutnala series. These soils have a silt loam surface layer and are strongly acid to very strongly acid. Fertility is low, and the available water capacity is moderate.

The risk of erosion is severe on these soils, and they should not be cultivated more than once in 3 or 4 years. Contour planting and stripcropping with grass are required. Tree windbreaks are needed in coastal areas where strong winds blow. Mutnala soils are shallow over gravelly material and are not well suited to cultivated crops. Kachemak soils at elevations of more than 1,200 to 1,400 feet also are not well suited to cultivated crops; the growing season is short and soil temperatures are low. These areas are well suited to grazing, but the native grasses are replaced by less desirable plants if overgrazed.

MANAGEMENT GROUP 11 (IVw-1)

Only Anchor Point and Killey silt loams are in this group. These soils are nearly level and occur on natural levees and flood plains. They are somewhat poorly drained and are subject to overflow when snow melts in spring.

Artificial drainage is required in most areas if these soils are cultivated. After the danger of spring flooding has passed, these soils can be used for garden crops and for pasture. Because flooding occurs less frequently in some areas along the North Fork River, limitations for cultivated crops are fewer than in other areas.

MANAGEMENT GROUP 12 (IVw-2)

This group consists of strongly sloping, poorly drained soils in the Beluga and Coal Creek series. They occur on foot slopes and benches and are always wet from seepage.

These soils are well suited to grass crops and pasture but are not well suited to row crops. Artificial drainage is required in cultivated areas, and row crops should not be grown more than once in 3 or 4 years. Contour planting and stripcropping with grass are needed to control erosion in cultivated areas.

MANAGEMENT GROUP 13 (IVw-3)

This group consists of nearly level to gently sloping, somewhat poorly drained and poorly drained soils in the Coal Creek, Slikok, and Spenard series. These soils occur in depressions and on flood plains and have a water table that is always at or near the surface. The surface layer of the Coal Creek and Spenard soils is silt loam, and the surface layer of Slikok soil is mucky silt loam.

These soils are mostly covered by trees or shrubs, but large areas of open grassland that provide good native pasture are common. In years when rainfall is less than normal, wild hay can be harvested in the open, grassy areas.

Artificial drainage and large amounts of fertilizer are required in cultivated areas. Drainage is difficult, and soils that can be drained do not dry early enough for growing potatoes or other crops that require the entire growing season to mature.

MANAGEMENT GROUP 14 (VIe-1)

This group consists of moderately steep, well-drained, silt loam soils in the Cohoe, Island, Kachemak, and Mutnala series.

These soils are not suited to cultivation. Native grasses suitable for grazing grow on the Kachemak and Island soils, and trees grow on the Mutnala and Cohoe soils. If these trees are cleared, the areas should be used only for permanent pasture.

MANAGEMENT GROUP 15 (VIc-1)

Kachemak silt loam, nearly level, is the only soil in this group. It occurs at elevations of 1,500 to 2,000 feet in the Caribou Hills.

This soil is suited to summer grazing but not to cultivated crops. Summer temperatures are low, the growing season is short, and the hummocky surface of this soil must be leveled before farm machinery can be used. Because of the cost of land preparation, hay crops probably are not feasible.

MANAGEMENT GROUP 16 (VIw-1)

Moose River silt loam is the only soil in this group. This soil is poorly drained. It occurs on flood plains and is subject to flooding in midsummer.

The soil cannot be drained so that cultivation is successful, but it does support good stands of native grasses and plants suitable for grazing.

MANAGEMENT GROUP 17 (VIw-2)

Only Tidal marsh is in this group. This land type consists of poorly drained, stabilized silty and clayey materials deposited near the mouths of principal streams. The water table is near the surface at all times. Most areas are subject to flooding by streams and occasionally by tidal water.

These areas cannot be artificially drained, and wetness limits the use of conventional farm machinery. The native vegetation is sedges, grasses, and other plants that can be grazed or cut for hay.

MANAGEMENT GROUP 18 (VIIe-1)

This group consists of well-drained, steep, silt loam soils in the Cohoe, Kachemak, and Mutnala series. The soils are too steep to be cultivated. Grass suitable for grazing grows on the Kachemak soil. Forest trees grow on the Cohoe and Mutnala soils. In a few areas these trees can be cleared for pasture, but most areas should be left in forest.

MANAGEMENT GROUP 19 (VIIe-2)

Bernice sandy loam, strongly sloping to steep, is the only soil in this group. This soil is very gravelly and is too shallow to gravelly material and too steep for cultivation. Most areas are forested. Grass grows in some areas at an elevation of more than 1,400 feet, but grazing is limited by the short, cold growing season. Grass for pasture is difficult to establish and maintain on this soil, and most areas should be left in native vegetation.

MANAGEMENT GROUP 20 (VIIw-1)

Grewingk fine sandy loam, strongly sloping to steep, is the only soil in this group. This soil is somewhat poorly drained and occurs on north-facing slopes that receive little direct solar radiation. The soil remains frozen until midsummer and is suited only to grazing. Grass for pasture is difficult to establish and maintain, and the soil should be left in native vegetation.

MANAGEMENT GROUP 21 (VIIw-2)

This group consists of very poorly drained, nearly level to moderately sloping peat soils of the Doroshin, Salamatof, and Starichkof series. These soils occur in muskegs and are waterlogged at all times. The peat is extremely acid and infertile, and these soils are not suitable for cultivation. Native sedges and grasses grow in the muskegs and provide very low amounts of forage for livestock.

MANAGEMENT GROUP 22 (VIIIs-1)

Rough broken land only is in this group. The areas are very steep, and because of undercutting, landslides are common on sea cliffs and terrace escarpments. The principal vegetation is alder brush, and many areas are barren.

MANAGEMENT GROUP 23 (VIIIw-1)

In this group are Alluvial land, Gravelly beach, and Tidal flats. These land types consist of recently deposited sediments along stream channels and tidal waters. Most areas are frequently flooded and have no value for farming, but plants that provide forage for grazing grow in some places near the mouth of the Fox River.

Native Vegetation [3]

Most of the native vegetation in the Homer-Ninilchik Area has not been disturbed by land clearing, grazing, logging, or recent fires. The most common vegetation types are white spruce forest, Sitka spruce forest, native grasslands, and low-growing plants of muskegs.

Forests are dominant at elevations of less than 800 feet, and native grasslands occur mainly at elevations of more than 800 feet. In the forests most trees and other plants root in the thin mat of forest litter, mosses, lichens, and fungal mycelia that cover the surface of the soils.

The white spruce forest type occurs on well-drained soils of the uplands north of Anchor Point. Only a few paper birch and cottonwood trees grow in the stands. The understory is mainly devilsclub, menziesia, highbush cranberry, bunchberry dogwood, wild rose, Sitka alder, mountain-ash, and bluejoint reedgrass. Mosses and lichens cover the forest floor.

Some white spruce in this area are as much as 200 years old. The stands have 100 to 150 trees per acre. The trees average about 10 inches in diameter and 60 to 75 feet in height. Because the root zone is shallow, the windthrow hazard is moderate in partly open stands. The Alaska spruce beetle *(Dendroctonus borealis)* causes some damage to trees. Following a fire or severe logging operations, quaking aspen and paper birch are the first trees to grow. White spruce

[3] The information in this section is based on the work of H. J. LUTZ (*8*).

gradually invades these stands and after about 80 years begins to replace these pioneer species. After 100 to 120 years white spruce is again dominant on the site.

The Sitka spruce forest type occurs in the more humid and warm parts of the survey area that border Kachemak Bay. This forest type is similar to the white spruce forest type, but it yields more timber.

White spruce and Sitka spruce provide good lumber for use in general construction. In a well-stocked stand 160 years old white spruce may yield about 15,500 board feet per acre (*8*). Paper birch is used for veneer and crates. This tree grows slowly, and decay is noticeable at 100 years of age. A mature stand of paper birch averages 30 to 50 feet in height and 8 to 14 inches in diameter. The cottonwood is suitable for crates and boxes, but almost no use is made of this tree. It is the largest tree that grows in the survey area. In a mature stand trees average 60 to 75 feet in height and 18 to 36 inches in diameter. Quaking aspen has little value as lumber. In a mature stand trees average 50 feet in height and 10 inches in diameter. Decay is common in trees that are 60 years old.

Forest products are used locally for construction and fuel. The demand for rough lumber is small. In the survey area, there are no planing mills or other facilities for processing wood, and most sawmills are operated only part time. Logging operations are difficult during spring thaw because logging roads become impassable. Many tracts of woodland are surrounded by muskegs, and most logging equipment cannot cross these muskegs except when the ground is frozen.

Natural grasslands are extensive in the Caribou Hills at elevations of more than 800 feet, in the vicinity of Homer, in the lower part of the Fox River Valley, and in many areas along the coast. Clumps of Sitka spruce grow on ridges and side slopes in the Caribou Hills.

The dominant grass is bluejoint reedgrass, and many stands are made up entirely of this plant. It is a coarse perennial that grows in tussocks that are as much as 18 inches tall. In locations and on soils that favor its growth, this grass may be as much as 4 to 6 feet tall. Other common plants are fescue, bluegrass, fireweed, geranium, cowparsnip, and horsetail.

At elevations of more than 1,500 feet and in abandoned clearings at lower elevations are mixed stands of bluejoint and low-growing shrubs and reedgrass. Monkshood, false helleshore, lupine, and waterhemlock also grow in some areas. These plants are toxic to livestock. They are grazed only early in spring or where other vegetation is sparse in overgrazed pastures.

Most of the muskegs have a surface cover of sphagnum moss. Other plants are cottonsedge, bog-birch, Labrador-tea, dwarf-willow, lingenberry, crowberry, bog-blueberry, and cloudberry. Cottonsedge is dominant at elevations of more than 800 feet. Except for scattered stands of spindly black spruce that grow at the outer edges of the muskegs, most muskegs are treeless.

The vegetation common to the six soil associations in the Homer-Ninilchik Area is discussed in the following paragraphs. By referring to the colored map at the back of this survey and to the descriptions of the soil associations in the section "General Soil Map," the reader can relate differences in the vegetation that grows in a given area to differences in soil material, drainage, slope, elevation, and local rainfall.

Cohoe-Salamatof association.—On the well-drained soils on uplands of this association, the main vegetation is a climax forest of white spruce, but patches of grassland are common in the northern part. The dominant plants in these areas are bluejoint reedgrass, fireweed, lupine, and cowparsnip. Clumps of elderberry and alder are common in areas near the coast. White spruce are slowly invading the edges of most open areas in forests, and mixed stands of paper birch and white spruce occur in some areas.

On the poorly drained, mineral soils in this association are forests of black spruce. The understory consists of willows, horsetail, bluejoint reedgrass, and sedges. Black spruce and white spruce grow in sparse stands on bottom lands along streams, and the understory is low-growing willows. Cottonwood trees grow on the natural levees of streams. Many muskegs occur on the poorly drained soils in this association.

Mutnala-Salamatof association.—This association receives more precipitation and has warmer temperatures than the Cohoe-Salamatof association. The dominant vegetation on the well-drained soils is a climax forest of Sitka spruce. In areas along the coast, the understory is a dense thicket of devilsclub and Sitka alder. Where this association adjoins the Kachemak association, the forest is less dense; many paper birch trees grow and open spots of bluejoint reedgrass are common in these areas.

Sparse stands of black spruce and white spruce grow on bottom lands along streams. Groves of cottonwood trees are on natural levees adjacent to streams. The understory in most places is made up of willows, horsetail, and bluejoint reedgrass. The vegetation in muskegs is that common in muskegs at low elevations.

Kachemak association.—Natural grasslands cover most of the well-drained soils in this association. In most places the grass is 5 to 6 feet high, but it is generally less than 2 or 3 feet high at elevations of more than 1,400 feet. The vegetation at lower elevations is dominantly bluejoint reedgrass, but that at higher elevations is mixed. Clumps of Sitka spruce are common below 1,400 feet. Willow thickets are common on colluvial slopes and in draws. Alder trees grow on the hilltops and along the large drainageways. Cottonsedge is the dominant plant in muskegs, but a mixture of plants that are common in muskegs at low elevations grow in some places.

Beluga association.—Sparse stands of Sitka spruce, paper birch, and cottonwood are common in this association. Sitka alder grows along drainageways. Open areas support a dense cover of bluejoint reedgrass, fireweed, cowparsnip, horsetail, lupine, devilsclub, red currant, wild cucumber, and clumps of elderberry bushes. Muskegs are few in this association, and the vegetation is that common in muskegs at low elevations.

Alluvial land-Tidal marsh association.—In this association thickets of black spruce are common. Well-drained areas of Alluvial land support a dense cover of Sitka alder, horsetail, bluejoint reedgrass, and cottonwood, and poorly drained areas are covered by sedges,

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horsetail, willows, and goosetongue. Cottonwood trees grow on the natural levees along the streams. The vegetation on the tidal flats is sedges, beach wild-rye, alkaligrass, horsetail, and other plants that commonly grow in meadows along the coast.

Rough broken land association.—This association has a sparse vegetation of Sitka alder and devilsclub.

The principal trees, shrubs, forbs, grasses and sedges, and mosses that grow in the Homer-Ninilchik Area are listed in the following paragraphs. Both the common name and the Latin name are given.

The principal trees are white spruce *(Picea glauca)*, Sitka spruce *(Picea sitchensis)*, black spruce *(Picea mariana)*, paper birch *(Betula papyrifera)*, quaking aspen *(Populus tremuloides)*, and black cottonwood *(Populus trichocarpa)*.

The principal shrubs in the area are Sitka alder *(Alnus sinuata)*, bog birch *(Betula glandulosa)*, bunchberry dogwood *(Cornus canadensis)*, crowberry *(Empetrum nigrum)*, Labrador-tea *(Ledum palustre*, var. *groenlandicum)*, devilsclub *(Oplopanax horridus)*, American red currant *(Ribes triste)*, wild rose *(Rosa acicularis)*, Cloudberry *(Rubus chamaemorus)*, trailing raspberry *(Rubus pedatus)*, redberried elder *(Sambucus racemosa)*, Greenes mountain-ash *(Sorbus scopulina)*, bog-blueberry *(Vaccinium uliginosum)*, lingenberry *(Vaccinium vitis-idaea)*, and highbush cranberry *(Viburnum edule)*.

The principal forbs that grow in the area are bluntleaf sandwort *(Arenaria lateriflora)*, northern comandra *(Comandra livida)*, spreading wood fern *(Dryopteris austriaca)*, oakfern *(Dryopteris disjuncta)*, fireweed *(Epilobium angustifolium)*, field horsetail *(Equisetum arvense)*, meadow horsetail *(Equisetum pratense)*, creeping rattlesnake-plantain *(Goodyera repens* var. *ophioides)*, bluntleaf habenaria *(Habenaria obtusata)*, cowparsnip *(Heracleum lanatum)*, American twinflower *(Linnaea borealis* var. *americana)*, Nootka lupine *(Lupinus nootkatensis)*, goose-tongue *(Plantago maritima)*, northern listera *(Listera cordata)*, bristly clubmoss *(Lycopodium annotinum)*, Alpine pyrola *(Pyrola asarifolia* var. *incarnata)*, sidebells pyrola *(Pyrola secunda)*, green pyrola *(Pyrola virens)*, wild cucumber *(Streptopus amplexifolius)*, and Arctic starflower *(Trientalis europaea* ssp. *arctica)*.

The principal grasses and sedges that grow in the area are foxtail *(Alopecurus* spp.), bluejoint reedgrass *(Calamagrostis canadensis)*, meadow sedges *(Carex* spp.), tufted hair-grass *(Deschampsia caespitosa)*, beach wild-rye *(Elymus mollis)*, cottonsedge *(Eriophorum vaginatum)*, Altai fescue *(Festuca altaica)*, red fescue *(Festuca rubra)*, meadow barley *(Hordeum brachyantherum)*, woodrush *(Luzula* spp.), Alpine timothy *(Phleum alpinum)*, bluegrass *(Poa* spp.), and alkaligrass *(Puccinellia* spp.)

The principal mosses in the area are *Dicranum fuscescens, Drepanocladus uncinatus, Hylocomium splendens, Hypnum crista-castrensis* (syn. *Ptilium crista-castrensis), Pleurozium schreberi, Polytrichum commune,* and *Sphagnum* spp.

The principal lichens in the area are *Cladonia* spp., *Peltigera aphthosa* var. *typica,* and *Peltigera membranacea.*

Wildlife [4]

Many kinds of game animals, furbearers, migratory waterfowl, upland game birds, songbirds, and many other small animals frequent the Homer-Ninilchik Area. Trout, Arctic grayling, and salmon are in the larger streams. Halibut, salmon, and king crab are taken from the offshore waters. Tides in the survey area range to more than 25 feet. In places clam beds occur in areas that are exposed during extreme low tides.

Moose are the most important game animals in this survey area. Some of the bulls weigh more than 1,400 pounds, but the cows are smaller and weigh less. Moose feed mainly on wood vegetation, particularly willow, birch, and aspen, but in spring and summer they also feed on aquatic plants, grasses, and other kinds of succulent plants. The moose population fluctuates according to the climatic conditions, habitat, fires, and the number killed by hunters.

Caribou herds formerly grazed in the Caribou Hills, but they disappeared early in the 1900's. In 1966 the Alaska Department of Fish and Game released a small herd for breeding. Caribou feed mainly on low-growing shrubs, grasses, and sedges in summer and on lichens in winter. Black bears and brown bears also live in the Homer-Ninilchik Area. Their food includes large and small mammals, fish, insects, and many kinds of wild herbs and wild berries.

Important furbearers are beaver, mink, marten, lynx, fox, wolverine, and muskrat. Other animals in the survey area are porcupine, marmot, ground squirrel, red squirrel, and shrew.

Spruce grouse is common in the forests and is the most important upland game bird.

Many migratory birds and waterfowl stop over, and a number nest in the survey area. Gulls, cormorants, and puffins are common in coastal areas. Birds of prey include the bald eagle, owls, and hawks. Ravens, Canadian jays, and many kinds of songbirds also inhabit the survey area.

The wildlife in the six soil associations of the Homer-Ninilchik Area is discussed in the following paragraphs. The number and kinds of wildlife in a given area depend on the vegetation and characteristics of the soils. By referring to the description of the associations in the section "General Soil Map" and to the discussion of vegetation common in each in the subsection "Native Vegetation," the reader can relate differences in the kind of wildlife to differences in vegetation and soils.

Cohoe-Salamatof association—This soil association is a favorable habitat for many kinds of wildlife, for there are mature forests of white spruce that have many grassy openings, broad muskegs that border lakes and streams in which aquatic plants grow, and flood plains that are covered by brush.

Moose find food in this association throughout the year. In spring and summer they feed on the pondweed and pondlily that grow in lakes and other streams.

[4] This section is based in part on information supplied by JACK C. DIDRICKSON, game biologist, Alaska Department of Fish and Game, Palmer, Alaska.

Sedges and horsetail are common on Salamatof peat in the muskegs. On the well-drained Cohoe and Island soils, moose browse bluejoint reedgrass, currant, fireweed, and other kinds of shrubs and grasses. When the snow covers the browse in the mountains and the Caribou Hills, the moose migrate to lower elevations where the snow is not so deep. Here they feed on the willow thickets that grow on the Moose River and Slikok soils and the shrubs that the forest understory provides.

Bears find this association favorable habitat because the forest is thick and cloudberry, blueberry, crowberry, and lingenberry are abundant in the muskegs. Several kinds of waterfowl nest along the borders of the muskegs and lakes and in marshy areas of flood plains. Salmon, trout, and grayling live in Deep Creek and the Ninilchik River.

Mutnala-Salamatof association—In this association are the well-drained Mutnala soils on low hills and the very poorly Salamatof soils that occupy broad muskegs. The Mutnala soils, which are dominant, support mature stands of Sitka spruce and an understory of devilsclub, currant, and other shrubs. The Salamatof, or peat, soils are covered by mosses, sedges, wildberries, and other low-growing shrubs and forbs.

This complex pattern of soils and the different kinds of vegetation provide a suitable habitat for moose, squirrel, spruce grouse, waterfowl, yellowlegs, and other birds and small animals that are common in the survey area. The waterfowl nest in areas that border the lakes, and the yellowlegs and other birds nest in the muskegs. Squirrels, spruce grouse, and other birds and small animals are abundant in the spruce forests. Moose browse the understory of wooded areas, the sedges and grasses in the muskegs, and the aquatic plants that grow in the lakes. Grayling and trout are in the Anchor River and its tributaries, which are also spawning waters for runs of salmon, particularly king salmon and silver salmon.

The Anchor Point, Killey, Salamatof, and Slikok soils are on the flood plains of the Anchor River. They support willows and tall grasses that provide browse and cover for moose. Beaver, waterfowl, muskrat, and other small animals also are plentiful in and around the many sloughs, pools, and abandoned channels on the flood plains.

The upper part of the Anchor River Valley consists of forested areas on side slopes, natural grasslands at elevations of more than 800 feet, and broad muskegs that are covered by sedges, mosses, blueberries, lingenberries, cloudberries, and crowberries. This type of habitat attracts birds, bears, moose, and a number of small animals. In winter the moose migrate to lower elevations where the snow is not so deep.

Kachemak association—The Kachemak soils, which are dominant in this association, have a cover of grass. Mutnala soils occur on lower side slopes and are wooded. Starichkof peat is in the broad muskegs and is covered by sedges, mosses, and wild berries. In addition, dense thickets of willows grow on the Anchor Point and Coal Creek soils that occur in narrow valleys.

The thick mat of straw that covers the Kachemak soils and the seeds of grasses that grow on them provide a favorable habitat for small ground animals. The wooded areas and the willow thickets are a suitable habitat for bears. Moose also browse these areas in summer, fall, and early in winter, but they migrate to lower elevations when the snow is deep enough to cover the willows.

Beluga association—This association is in the vicinity of Homer, the most heavily populated part of the survey area. The vegetation is mainly tall grasses, but in places there is a sparse forest of Sitka spruce and paper birch. Birds and small animals are the most abundant wildlife in this association. Moose concentrate here in winter, when deep snow forces them to leave the Caribou Hills.

Alluvial land-Tidal marsh association.—This association is in the Fox River Valley. It supports a variety of plants that provide a suitable habitat for many kinds of wildlife. Sitka spruce grows on the side slopes of the valley. The vegetation on the Beluga soils is mainly bluejoint reedgrass, but in places there are forests of black spruce, clumps of alder, and willow thickets. Alluvial land, which is adjacent to Sheep Creek and the Fox River, support willows, alders, and bluejoint reedgrass. Sedges, goosetongue, and other water-loving plants grow in areas of Tidal march.

Moose range the Fox River Valley all year, but they are more common in winter. This association is also a good habitat for black bears and brown bears. The abandoned channels, Tidal flats, Tidal marsh, and open areas along streams attract flocks of migratory birds and shore birds. Sheep Creek and the Fox River, which flow through the association, are poorly suited to sport fishing because they are laden with silt.

Rough broken land association.—This association is made up of sea cliffs, escarpments, and canyon walls along creeks that flow into Kachemak Bay. Many areas are bare, but there are also dense thickets of alder and patches of grass and other plants. The very steep and almost inaccessible areas support dense thickets of alder that provide suitable habitat for bears and protective cover for many birds and small animals.

Engineering Uses of Soils

This section contains information about the use of soils as material in construction. Some properties of soils are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, irrigation systems, and sewage disposal systems. Among the properties most important to the engineer are permeability to water, shear strength, compactability, soil drainage, shrink-swell potential, grain-size distribution, plasticity, and reaction. Depth to the water table, depth to bedrock, slope, and available water capacity are also important.

The information in this soil survey can be used to—

1. Make soil and land use studies that will aid in selecting and developing sites for industrial, business, residential, and recreational purposes.
2. Make preliminary estimates of the engineering properties that help in planning farm drainage

systems, farm ponds, irrigation systems, waterways, and other structures for conservation of soil and water.
3. Make preliminary evaluations of soil conditions that will aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
4. Locate probable sources of sand and gravel and other material suitable for construction.
5. Correlate performance of existing structures with soil mapping units, and thus develop information that can be useful in designing and maintaining future structures.
6. Determine the suitability of soils for off-road movement of vehicles and construction equipment.

With the use of the soil map for identification, the engineering interpretations in this section can be useful for many purposes. It should be emphasized, however, that the interpretations do not eliminate the need for sampling and testing at the site of specific engineering works where loads are heavy and where the excavations are deeper than the layers reported. Even in these situations, however, the soil map is useful in planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Much of the information in this section is given in tables 4, 5, and 6. Additional information useful to engineers can be found in other sections of this soil survey, particularly the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

Some of the terms used by soil scientists may not be familiar to the engineer, and some commonly used terms may have special meaning in soil science. Several of these terms are defined in the Glossary at the back of this survey.

Engineering classification systems

Two systems of soil classification are in general use among engineers. Both are used in this soil survey.

Many highway engineers classify soil material according to the system approved by the American Association of State Highway Officials (AASHO) *(1)*. In this system soil material is classified in seven principal groups. The groups range from A–1, consisting of gravelly soils of high bearing capacity, to A–7, consisting of clay soils that have low strength when wet. Within each group the relative engineering value of the soil material is indicated by a group index number. Group index numbers range from 0 for the best material to 20 for the poorest. They are shown in parentheses following the group symbol, for example, A–4(6) as is given for the surface layer of Beluga silt loam in table 6.

Some engineers prefer to use the Unified classification system *(13)*. In this system soils are grouped on the basis of texture, plasticity, and their performance as material for engineering structures. Soil material is identified as coarse grained (eight classes), fine grained (six classes), or highly organic. The classification of the soils tested according to the Unified system is given in table 6, and the estimated classifications for most soils in the survey area are given in table 4.

The United States Department of Agriculture classifies soils according to texture, which is determined by the proportion of sand, silt, and clay in the soil material *(11)*. The terms "sand," "silt," and "clay" are defined in the Glossary at the back of this survey.

Engineering properties of soils

Table 4 gives estimates of soil properties that are important in engineering and lists estimated Unified and AASHO classifications. The textural terms for the horizons are those used by the U.S. Department of Agriculture. The estimates given in table 4 are based on the test data in table 6 and on the soil descriptions.

The depth to bedrock is not given in table 4, because hard bedrock normally is at a depth of more than 5 feet in the soils in the survey area. However, moderately consolidated shale is at a depth of about 20 to 40 inches in the Kachemak soils. Because all of the soils in this survey area have a high potential for corroding untreated steel pipes, corrosion potential is not listed in table 4.

Depth to a seasonal high water table is indicated in table 4. Use of soils for highways and other construction is limited by a seasonal high water table.

The column headed "Depth from Surface" lists the depths that correspond to significant changes in texture in the technical profile described as typical for the series. Some of the layers given in the technical profile have been combined.

Listed for the layers in table 4 are the USDA textural classification, the Unified and AASHO engineering classifications, and the estimated percentages of material that passes Nos. 4, 10, and 200 sieves. The amount of material passing a No. 200 sieve determines whether soil material is coarse grained or fine grained.

Permeability refers to the rate that water moves through the soil. It depends mainly on texture and structure, but it also may be affected by other physical properties. In table 4 permeability is estimated in inches of water percolation per hour. It was determined for soils without compaction and after the removal of free water.

The available water capacity, estimated in inches per inch of soil depth, is the approximate amount of capillary water in a soil that is wet to field capacity. Poorly drained soils normally contain more than this amount of water before drainage.

In table 4 reaction is given in pH values that indicate degree of acidity or alkalinity. Reaction is defined in the Glossary at the back of this publication.

Dispersion refers to the degree and rate of the breakdown, or slaking, of the soil structure in water.

Shrink-swell potential indicates the volume change of soil material expected with a change in moisture content. Ratings are low, moderate, and high. They were estimated primarily on the basis of the amount and kind of clay that soil contains. Most of the soils in the Homer-Ninilchik Area have low shrink-swell potential.

Engineering interpretations of soils

In table 5 the soils of the Homer-Ninilchik Area are

rated according to their susceptibility to frost action and their suitability as a source of topsoil, sand, gravel, and road fill. In addition, the table lists soil features that affect location of highways and the construction and maintenance of farm ponds, drainage systems, irrigation systems, and waterways. The interpretations are based on the estimated soil properties shown in table 4, on the test data shown in table 6, and on field experience.

Frost action is a major concern where the soils in the Homer-Ninilchik Area are used for engineering. Although a precise correlation has not been established, it is believed that in the survey area only soils containing less than 6 percent of material fine enough to pass the No. 200 sieve (0.074 millimeter) are not susceptible to frost heaving. Because of the difficulty in maintaining the moisture content suitable for compaction when soil is frozen, it is not advisable to construct embankments and other earthworks with frost-susceptible material during winter.

Most of the uplands in the survey area are covered with a mantle of silty material deposited by the wind. In some areas of Cohoe soils, this mantle is 60 inches thick, but it is most commonly 15 to 40 inches thick. The silty material is highly susceptible to frost action and generally is not good material for use in construction. It is very dusty when dry and is soft and slippery when wet. It may not support repeated passes of heavy equipment when wet.

Several different kinds of material underlie the silty material in the well-drained soils of the uplands. In the Cohoe, Island, and Kachemak soils, the substratum generally consists of layered fine-grained and coarse-grained sediments, but gravelly and pebbly strata that vary in thickness also occur. Generally the properties of these soils are less favorable for construction than those of soils that have a thick gravelly substratum. Deposits of sand and gravel are within areas of these soils but are not common. The Mutnala soils are underlain by coarse gravelly glacial drift that is many feet thick and moderately permeable. In Mutnala soils the water table generally is more than 5 feet below the surface. Many gravel pits are in areas of these soils.

Most soils in upland depressions and on flood plains are wet throughout the summer and are susceptible to frost action in spring. In summer they can be crossed only by vehicles designed to operate in wet areas. The Island soils are exceptions. They are not wet all summer and are less severely affected by frost heaving than other soils in depressions.

Peat soils in muskegs are common in the Homer-Ninilchik Area. These soils are nearly always wet to the surface. The peat has no value as construction material or for use as a foundation. Embankments for roads through muskegs may rest directly on the underlying mineral soil or, where the peat is more than 5 feet thick, they may be constructed on logs.

Contour cultivation, stripcropping, establishing waterways, and other practices probably can provide adequate control of erosion on all except the steep soils in the Homer-Ninilchik Area. Heavy showers during which runoff water concentrates are not likely. Unless the steep soils are cleared and farmed, terraces, dams, and similar structures are not likely to be needed.

Draining most of the wet soils for farming probably is not feasible or economically practical until a much greater part of the uplands is cleared. The somewhat poorly drained Beluga soils, however, are relatively easy to drain by interceptor ditches, and where drained, these soils respond well to good management.

Drainage of the peat soils is not a good practice, because these soils are low in fertility and are difficult to drain.

Soil test data

To help evaluate the soils for engineering purposes, samples were taken from soils of the Beluga, Cohoe, and Kachemak series and were tested by the Alaska Department of Highways in accordance with standard procedures of the American Association of State Highway officials (AASHO) *(1)*. The test data obtained from samples from three profiles of each soil series are given in table 6. The samples were chosen to represent the range in properties in the soils of each series. One profile represents the modal, or typical, soil of each series. The other two profiles, though within the range permitted in the series, differ from the modal profile in texture, consistence, or some other property significant in engineering. Also shown in table 6 is the classification of each sample according to the AASHO and Unified systems.

Moisture density, the relation of moisture content and the density to which a soil material is compacted, is given in table 6. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture. The highest dry density obtained in the compaction test is termed maximum dry density. Moisture-density data are important in earthwork, for as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

The engineering soil classifications in table 6 are based on data obtained by mechanical analyses and by tests to determine liquid limit and plastic limit. The mechanical analyses were made by the combined sieve and hydrometer methods. The percentage of clay obtained by the hydrometer method should not be used in naming the textural classes of soils.

The liquid limit and plasticity index given in table 6 indicate the effect of water on the consistence of the soil material. As the moisture content of a clayey soil increases from a very dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

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TABLE 4.—*Estimated engineering*

[Absence of data indicates estimate was not made. The sign < means less than, and > means more than. Alluvial

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO
	Feet	*Inches*			
Anchor Point: Ap (For properties of Killey soil in this mapping unit, refer to the Killey series.)	1-3	0-27	Layered silt loam, loamy very fine sand, and fine sandy loam.	ML or SM	A-4 or A-2
		27-49	Very gravelly sand	GP or GW	A-1
Beluga: BaA, BaB, BaC, BaD	<1	0-27	Layered silt loam and fine sandy loam.	ML	A-4
		27-40	Silty clay loam	CL	A-6
Bernice: BeE	>5	0-5	Silt loam	ML	A-4
		5-24	Gravelly sandy loam and very gravelly loam.	GM	A-1
Coal Creek: CkA, CkB, CkC, CkD	<1	0-15	Silt loam	ML	A-4
		15-31	Gravelly silt loam	ML or SM	A-4
Cohoe: CoA, CoB, CoC, CoD, CoE, CoF	>5	0-25	Silt loam	ML	A-4
		25-80	Layered sand, gravelly sandy loam, and silt loam.	SM	A-2
Doroshin: DoA, DoB, DoC	<1	0-19	Peat	Pt	
		19-36	Silt loam and silty clay loam	CL	A-6
Gravelly beach: Gb	0-4	0-60	Very gravelly sand	GP or GW	A-1
Grewingk: GrE	1-3	0-17	Layered silt loam, gravelly sandy loam, and gravelly sand.	SM	A-2
		17-24	Gravelly clay loam	GM	A-6 orA-2
Island: IaA, IaB, IaC, IaD, IaE	>5	0-42	Silt loam	ML	A-4
		42-48	Fine sand	SP or SW	A-3
Kachemak: KhA, KhB, KhC, KhD, KhE, KhF.	>5	0-17	Silt loam	ML or MH	A-4 or A-5
		17-39	Silt loam	ML	A-4
		39	Shale.		
Killey (Mapped only with Anchor Point soils.)	1-3	0-44	Layered silt loam and fine sand	ML or SM	A-4 or A-2
		44-49	Very gravelly sand	GP or GW	A-1
Moose River: Mo	<1	0-38	Layered fine sand and silt loam	SM	A-2
		38-44	Very gravelly sand	GP or GW	A-1
Mutnala: MuA, MuB, MuC, MuD, MuE, MuF.	<5	0-22	Silt loam	ML	A-4
		22-30	Gravelly sandy loam	GM	A-1
Nikolai: Nl	1-2	0-22	Mucky silt loam	OL	A-5
		22-31	Peat	Pt	
		31-40	Silt loam	ML	A-4
Salamatof: Sa	<1	0-42	Peat	Pt	
Slikok: SkA, SkB	<1	0-15	Mucky silt loam	OL	A-5
		15-30	Silt loam	ML	A-4
Spenard: SpA, SpB, SpC	1-2	0-31	Silt loam	ML	A-4
		31-40	Silt loam	ML	A-4
Starichkof: SrA, SrB	<1	0-42	Peat	Pt.	
Tidal marsh: Tm	<1	0-42	Silty clay loam	CL or CH	A-6 or A-7

properties of soils

land (Ad), Rough broken land (Ro), and Tidal flats (Ta) have variable properties and are not included in this table]

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
No. 4 (4.76 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
			Inches per hour	*Inches per inch of soil*	*pH*		
100	90–100	30–70	0.63–2.0	0.15–0.18	4.5–5.5	High to moderate	Low.
40–50	30–40	<5	> 6.3	0.02–0.04	4.5–5.5	Low	Very low.
90–100	80–100	50–80	0.63–2.0	0.15–0.18	5.0–6.0	High	Low to moderate.
100	90–100	75–90	0.2–0.63	0.19–0.21	5.5–6.0	Moderate	Moderate.
90–100	80–90	60–70	0.63–2.0	0.18–0.20	4.5–5.5	High	Low.
40–50	30–40	15–25	6.3–20.0	0.06–0.08	4.5–5.5	Moderate to low	Low.
100	100	75–90	0.63–2.0	0.20–0.23	4.5–5.5	High	Low.
75–85	60–75	40–60	0.63–2.0	0.16–0.18	4.5–5.5	High to moderate	Low.
100	100	75–90	0.63–2.0	0.20–0.23	5.0–6.0	High	Low.
75–85	60–80	20–30	2.0–6.3	0.06–0.08	5.5–6.5	Low	Low.
...	...	...	0.63–2.0	>0.30	4.0–5.5	Low	High shrink, low swell.
100	100	80–90	0.63–2.0	0.19–0.21	4.0–5.5	High	Low to moderate.
35–45	20–30	<5	>6.3	<0.02	...	Low	Low.
80–90	70–80	20–30	2.0–6.3	0.06–0.08	4.5–5.5	Low	Low.
60–70	50–60	30–40	0.63–2.0	0.16–0.18	4.5–5.5	Moderate	Moderate.
90–100	85–95	70–80	0.63–2.0	0.20–0.23	5.0–5.5	High	Low.
70–85	60–80	<5	>6.3	0.02–0.04	5.0–5.5	Low	Low.
100	100	60–90	0.63–2.0	0.20–0.23	4.5–5.5	High	Low.
90–100	80–90	70–80	0.63–2.0	0.18–0.20	5.0–6.0	High	Low.
100	85–100	30–70	0.63–2.0	0.15–0.18	4.5–5.5	High to moderate	Low.
40–50	30–40	<5	>6.3	0.02–0.04	4.5–5.5	Low	Low.
90–100	80–90	25–35	0.63–2.0	0.12–0.15	5.5–6.0	Moderate	Low.
35–45	25–35	<5	>6.3	0.02–0.04	5.5–6.0	Low	Very low.
100	100	60–90	0.63–2.0	0.20–0.23	4.0–5.0	High	Low
50–60	50–60	15–25	0.63–2.0	0.06–0.08	4.5–5.5	Moderate	Low.
100	90–100	60–75	0.63–2.0	>0.30	4.5–5.5	Moderate	Low.
...	...	...	0.63–2.0	>0.30	4.5–5.5	...	Low.
100	100	75–90	0.2–0.63	0.63–2.0	4.5–5.5	High	Low.
...	...	...	0.63–2.0	>0.30	4.0–4.5	...	High shrink, low swell.
90–95	80–90	60–75	0.63–2.0	>0.30	4.5–5.5	Moderate	Low.
90–100	80–90	60–75	0.63–2.0	0.20–0.23	4.5–5.5	High	Low.
100	100	60–90	0.63–2.0	0.20–0.23	4.5–5.5	High	Low.
80–90	70–80	50–60	0.63–2.0	0.18–0.20	4.5–5.5	High	Low.
...	...	...	0.63–2.0	>0.30	4.0–5.0	...	High shrink, low swell.
100	100	85–95	0.2–0.63	0.19–0.21	6.6–7.3	Moderate	High.

TABLE 5.—*Engineering*

[Absence of entry indicates that the soil

Soil and map symbols	Susceptibility to frost action	Suitability as source of— Topsoil	Sand	Gravel	Road fill
Alluvial land: Ad	Low to moderate	Not suitable to poor.	Poor: admixture of silt and gravel in places.	Fair to not suitable: variable content of gravel.	Good to poor: variable texture of soil material; high water table in places.
Anchor Point: Ap (For interpretations of Killey soil in this mapping unit, refer to Killey series.)	Moderate to high	Fair to poor	Poor: stratified silty and fine sandy material over gravel.	Not suitable to a depth of 15 to 30 inches; seasonal high water table.	Fair to poor to a depth of 15 to 30 inches; good to excellent in substratum.
Beluga: BaA, BaB, BaC, BaD.	Moderate to very high.	Fair: high water table.	Not suitable	Not suitable	Poor: high water table.
Bernice: BeE	Low to moderate	Poor	Poor: high content of gravel.	Good: gravelly material throughout.	Good
Coal Creek: CkA, CkB, CkC, CkD.	Moderate to very high.	Fair to good in upper part; high water table in most places.	Not suitable	Poor: gravelly substratum in some places.	Poor to fair
Cohoe: CoA, CoB, CoC, CoD, CoE, CoF.	Moderate to very high.	Good	Not suitable	Not suitable in most places, but gravelly strata in a few places.	Poor
Doroshin: DoA, DoB, DoC.	Moderate to very high.	Not suitable	Not suitable	Not suitable	Not suitable
Gravelly beach: Gb	None to very low	Not suitable	Fair to good: sandy and gravelly throughout.	Good: all gravel is rounded.	Good
Grewingk: GrE	Moderate to high	Not suitable	Fair to poor: silty substratum in most places.	Poor: silty substratum in most places.	Good to poor in upper part of profile.
Island: IaA, IaB, IaC, IaD, IaE.	Moderate to high	Good	Poor: stratified sandy and silty substratum.	Poor to good: gravelly substratum in some places.	Poor in uppermost 3 to 5 feet; poor to good below a depth of 3 to 5 feet.
Kachemak: KhA, KhB, KhC, KhD, KhE, KhF.	Moderate to very high.	Good	Not suitable in surface layer; poor to good in substratum.	Poor in most places; gravelly substratum in places, especially at higher elevations.	Poor in uppermost 2 to 3 feet; good below a depth of 2 to 3 feet in some places.
Killey (Mapped only with Anchor Point soils.)	Moderate to high	Fair	Poor: stratified silt and fine sandy material over gravel.	Not suitable to a depth of 30 to 40 inches; seasonal high water table.	Fair to poor to a depth of 30 to 40 inches; good to excellent in substratum.

interpretations of soils

or land type is variable and is not rated]

Soil features affecting—					
Highway location	Pond reservoirs	Pond embankments; dikes and levees	Agricultural drainage	Irrigation	Waterways
Subject to flooding.		Good stability and permeability in sandy and gravelly areas; not suitable in silty areas.			
Subject to flooding; seasonal high water table.	Excessive seepage in substratum.	Fair to poor stability; moderate permeability.	Subject to flooding.	Available water capacity is moderate above substratum and is low in substratum; medium intake rate.	Nearly level.
High water table.	Poorly drained; high water table; seepage in substratum in some places.	Fair to poor stability; generally too wet for compaction.	Interceptor ditches needed to depth of slowly permeable substratum.	Moderate to high available water capacity; medium intake rate; clayey substratum.	Compact, clayey substratum.
Steep slopes.	Steep; rapid permeability.	Good stability; moderately rapid permeability.	Well drained.	Steep; gravelly material.	Steep; gravelly.
High water table; gravelly substratum; seepage; subject to flooding in places.	Excessive seepage in substratum.	Poor stability in upper part; moderate stability in substratum; wetness.	Interceptor ditches needed for seepage; ditch banks are unstable; subject to flooding in places.	High water table; wetness.	Moderately erodible; gravelly substratum.
Erodible in exposed cuts.	Seepage in substratum in some places.	Poor stability in silty material; stable in substratum; moderate permeability in substratum.	Well drained.	Moderately high available water capacity; medium intake rate.	Erodible.
Very poorly drained; water table near surface.	High water table.	Organic material.	Water table near surface; high available water capacity.	High water table.	Organic material; level.
Subject to tidal flooding.					
Seepage in cuts; steepness.	Moderate to moderately slow permeability.	Fair stability; moderate permeability.	Steep slopes.	Steep slopes.	Erodible.
Erodible.	Moderate permeability; seepage in substratum in places.	Silty material is unstable; good stability in substratum; moderate to rapid permeability in substratum.	Well drained.	Moderate available water capacity; medium intake rate.	Erodible.
Erodible in cuts.	Moderate permeability; porous gravelly or sandy substratum.	Silty material is unstable in upper part; substratum is variable.	Well drained.	Moderate available water capacity; medium intake rate.	Erodible.
Subject to flooding; seasonal high water table.	Excessive seepage in substratum.	Fair to poor stability; moderate permeability.	Subject to flooding.	Moderate to low available water capacity; medium intake rate.	Level.

TABLE 5.—*Engineering*

Soil and map symbols	Susceptibility to frost action	Suitability as source of—			
		Topsoil	Sand	Gravel	Road fill
Moose River: Mo	Moderate to high	Poor	Poor: fine sand and gravel commonly below water table.	Poor: gravel below water table.	Poor: high water table.
Mutnala: MuA, MuB, MuC, MuD, MuE, MuF.	Moderate to high	Good	Not suitable to a depth of 18 inches; poor in substratum.	Good: gravelly substratum.	Poor in upper part; good to excellent in substratum.
Nikolai: Nl	High	Good	Not suitable	Not suitable	Not suitable
Rough broken land: Ro	Low to very high	Not suitable	Good to not suitable: sandy in places.	Good to not suitable: gravelly in places.	Excellent to not suitable: gravelly and sandy material in places.
Salamatof: Sa	Moderate to very high.	Not suitable	Not suitable	Not suitable	Not suitable
Slikok: SkA, SkB	Moderate to very high.	Good	Not suitable	Not suitable	Not suitable
Spenard: SpA, SpB, SpC	Moderate to very high.	Fair	Not suitable	Not suitable	Poor
Starichkof: SrA, SrB	Moderate to very high.	Not suitable	Not suitable	Not suitable	Not suitable
Tidal flats: Ta	High	Not suitable	Poor: subject to flooding by high tides daily.	Not suitable	Not suitable
Tidal marsh: Tm	High	Poor	Not suitable	Not suitable	Not suitable

interpretations of soils—Continued

Soil features affecting—					
Highway location	Pond reservoirs	Pond embankments; dikes and levees	Agricultural drainage	Irrigation	Waterways
Poorly drained; subject to flooding.	Moderate permeability.	Good stability; moderate permeability; wetness.	High water table; subject to flooding.	High water table; wetness.	Level.
Numerous cuts and fills; hilly.	Rapid permeability in substratum.	Silty material is unstable; good stability in substratum; rapid permeability in substratum.	Well drained	Moderate available water capacity.	Erodible.
High in organic-matter content.	Moderate permeability.	Unstable material	Seasonal high water table.	High available water capacity.	Organic material; level.
Steep slopes	Steep slopes	Steep slopes	Not used for farming	Not used for farming	Steep slopes.
Very poorly drained; high water table.	High water table	Organic material	High water table; outlets are difficult to locate; high available water capacity.	High water table; wetness.	Organic material; level.
Poorly drained; high organic-matter content.	Moderate permeability in substratum.	Unstable material	High water table; high available water capacity; subject to flooding in places.	High water table; wetness.	High organic-matter content.
High water table	Seepage in some places.	Silty material is unstable; fair stability in substratum.	Seasonal high water table.	High water table; wetness.	Erodible.
Very poorly drained; high water table.	High water table	Organic material	High water table; high available water capacity; no outlets in most places.	High water table; wetness.	Organic material; level.
Not suitable	Subject to flooding by high tides daily.	Poor stability	No outlets	Subject to flooding by high tides daily.	Subject to flooding by high tides daily.
Occasional flooding	High water table	Fair stability; clayey material.	Occasional flooding	High water table; wetness.	Level.

TABLE 6.—*Engineering*

[Tests performed by the Alaska Department of Highways in cooperation with the U.S. Department of Commerce, Bureau of

Soil name and location	Parent material	Depth	Moisture density [1]		Percentage passing sieve—			
			Maximum dry density	Optimum moisture	3 in.	1½ in.	¾ in.	⅜ in.
		Inches	*Lb. per cu. ft.*	*Percent*				
Beluga silt loam:								
SE¼SE¼, sec. 17, T. 6 S., R. 13 W. (modal profile).	Colluvium.	2–8	95	22	...	...	...	...
		8–13	112	15	...	...	...	...
		32–42	109	18	...	...	...	...
SE¼NE¼, sec. 11, T. 6 S., R. 13 W. (coarser textured than modal).	Colluvium.	2½–6	110	16	...	...	100	99
		6–11	113	14	...	...	100	98
		37–48	97	22	...	...	...	...
NE¼SE¼, sec. 11, T. 6 S., R. 13 W. (finer textured than modal).	Colluvium.	5–14	91	25	...	...	...	...
		14–19	100	22	...	...	...	...
		19–37	96	25	...	...	...	...
Cohoe silt loam:								
SW¼NW¼, sec. 7, T. 2 S., R. 13 W. (modal profile).	Silt and volcanic ash over layered sediments.	4–7	78	34	...	...	...	...
		7–17	92	24	...	...	...	...
		25–39	132	6	100	99	94	89
		39–58	145	4	100	95	92	83
NW¼NE¼, sec. 10, T. 2 S., R. 14 W. (buried organic horizons).	Silt and volcanic ash over layered sediments.	2–6	73	40	...	...	...	...
		16–26	97	22	...	...	...	...
		26–34	117	13	...	...	...	...
NE¼SW¼, sec. 2, T. 4 S., R. 15 W. (gravelly substratum).	Silt and volcanic ash over gravelly terrace deposits.	2½–6	73	37	...	...	...	...
		10–17	84	28	100	97	89	89
		35–48	141	5	100	98	84	66
Kachemak silt loam:								
NE¼SE¼, sec. 35, T. 5 S., R. 13 W. (modal profile).	Volcanic ash over layered sediments.	4–6½	86	28	...	...	...	...
		9–14	80	30	...	...	...	...
		22–36	102	21	...	...	...	...
SE¼SE¼, sec. 8, T. 6 S., R. 13 W. (gravelly substratum).	Volcanic ash over gravelly sediments.	5½–8	68	42	...	...	...	...
		13–22	94	22	88	86	83	81
		33–40	124	10	100	95	86	74
SE¼NW¼, sec. 12, T. 6 S., R. 14 W. (sandy substratum).	Volcanic ash over sandy sediments.	5–7½	67	48	...	...	...	...
		15–20	96	23	...	...	...	...
		28–40	101	19	...	...	...	...

[1] Based on AASHO Designation T-180D, Note 2*(1)*.

[2] Mechanical analyses according to the AASHO Designation: T 88*(1)*. Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

test data

Public Roads, in accordance with standard procedures of the American Association of State Highway Officials (AASHO) *(1)*

Mechanical analyses [2]								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—				Percentage smaller than—						AASHO [3]	Unified [4]
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
....	100	98	67	56	43	21	9	34	[5]NP	A–4(6)	ML
....	100	96	58	46	30	13	6	27	NP	A–4(5)	ML
....	100	98	74	60	47	22	11	32	NP	A–4(8)	ML
93	79	75	27	24	15	5	2	26	NP	A–2–4(0)	SM
93	88	84	46	36	17	7	3	23	NP	A–4(2)	SM
....	100	96	79	70	51	20	9	45	NP	A–5(9)	ML
....	100	99	83	73	52	20	8	47	NP	A–5(9)	ML
....	100	98	76	68	50	23	9	41	NP	A–5(8)	ML
....	100	99	86	76	54	38	17	48	NP	A–5(10)	ML
....	100	98	67	59	38	9	3	58	NP	A–5(10)	MH
....	100	99	83	60	44	12	3	36	NP	A–4(8)	ML
85	81	62	17	14	7	2	0	[6]NV	NP	A–2–4(0)	SM
73	60	53	29	23	11	6	2	27	4	A–2–4(0)	SM–SC
....	100	97	90	60	38	7	3	55	NP	A–5(11)	MH
....	....	100	93	61	40	9	3	31	NP	A–4(8)	ML
....	100	99	90	57	28	8	3	19	NP	A–4(8)	ML
....	100	97	63	50	24	4	1	36	NP	A–4(6)	ML
89	89	86	59	49	27	5	2	50	NP	A–5(6)	MH
51	40	29	10	8	4	1	0	NV	NP	A–1–a(0)	GP–GM
100	99	98	89	54	34	8	2	45	NP	A–5(9)	ML
....	100	98	70	56	37	8	2	59	NP	A–5–(10)	MH
....	100	94	75	60	35	14	7	30	NP	A–4(8)	ML
....	100	97	66	52	31	7	3	61	NP	A–5(9)	MH
80	78	75	53	40	27	7	3	37	NP	A–4(1)	ML
64	52	47	33	29	20	7	3	21	NP	A–2–4(0)	SM
....	100	98	60	51	28	5	1	59	NP	A–5(7)	MH
....	100	98	33	27	18	5	1	35	NP	A–2–4(0)	SM
....	100	95	20	13	6	2	1	NV	NP	A–2–4(0)	SM

[3] Based on AASHO Designation: M 145–49*(1)*.
[4] Based on the Unified Soil Classification System, Tech. Memo. No. 3–357, v. 1, Corps of Engineers *(13)*. SCS and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within two points of the A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are SM-SC and GP-GM.
[5] NP = Nonplastic.
[6] NV = No value.

Formation and Classification of Soils

In this section the major factors of soil formation are discussed in terms of their effect on the development of the soils in the Homer-Ninilchik Area. The current system of classification is briefly described, and the soils in the survey area are placed in some classes of that system. The soil series in the survey area, including a typical profile for each series, are described in the section "Descriptions of the Soils."

Factors of Soil Formation

The characteristics of any given soil result from the combined influence of the five genetic factors of the natural environment and the effects of the cultural environment and man's use of the soil *(6)*. The major factors of soil formation are parent material, climate, vegetation, relief, and time.

Climate, apart from its influence on soil properties, determines to a large extent the kind of vegetation that grows in a particular area. The vegetation, in turn, has a profound influence on soil characteristics. The degree of modification of the parent material or rock by climatic and biologic forces and the degree of soil development depend largely on the length of time the soil-forming processes have been active. Local variations in relief also affect the nature and intensity of soil development. For example, in low-lying areas a permanent high water table may cause the formation of a different kind of soil than is formed on the well-drained uplands within the same general area.

Parent material

Most soils on uplands in the survey area formed in silty wind-laid material. This material is a mixture of materials derived from glacial drift and volcanic ash from the Aleutian Range to the west. The volcanic ash probably is dominant in the southern part of the survey area, but it is less prevalent to the north. The silty mantle ranges from a few inches to more than 60 inches in thickness. The Cohoe soils are examples of soils that formed in silty material and volcanic ash. The entire survey area is underlain by sediments of the Kenai formation of Tertiary (Eocene) age. The sediments consist of poorly consolidated strata of sand, silt, and clay, and thin beds of lignite.

Much of the survey area has been glaciated. Coarse gravelly moraines are common in the area that borders Kachemak Bay. Areas of gravelly outwash occur in parts of the upland plain that borders the deeply incised valleys of Deep Creek and the Ninilchik River. Deposits of till are common at higher elevations in the Caribou Hills, but in a large part of the survey area, the silty wind-laid material rests directly on the Tertiary sediments. The Mutnala are examples of soils that formed in silty material over glacial till. Most of the Cohoe and Kachemak soils formed in silty material over Tertiary sediments.

On the alluvial plains and in many of the upland depressions, the soils formed in material deposited by streams or washed in from surrounding slopes. Most of these soils are silty, but a few on valley bottoms are coarse textured. Many depressions are filled with peat soils that formed mostly from the accumulated remains of mosses and sedges. The Salamatof are examples of soils that formed in peat. These peat bogs, or muskegs, range from many square miles to less than an acre in size.

Climate

The Homer-Ninilchik Area has cool summers and moderately cold winters. Because the rates of evaporation and transpiration are comparatively low, much of the precipitation percolates through the soil and is effective in leaching. Under the native vegetation the well-drained soils are cool and moist throughout the summer, but the temperature is high enough in the soils of the survey area to prevent the formation of permafrost.

Vegetation

In the survey area the well-drained soils of the uplands that are at elevations of less than 800 feet generally support a forest of white spruce or Sitka spruce and some paper birch. The native vegetation on the well-drained soils at an elevation of more than 800 feet is mainly a dense stand of native grasses. The somewhat poorly drained and poorly drained soils on the alluvial plains and in the upland depressions have a forest cover of willow, cottonwood, and black spruce in which there are many grassy areas. Low shrubs and black spruce grow in the muskegs. A more detailed description of the vegetation of the survey area is given in the section "Native Vegetation."

Relief

The soils in this survey area are comparatively young, and the effect of relief and topographic position, though considerable, is not so great on them as on older soils. On most but not all of the steep slopes, the silty mantle is somewhat thinner than it is in level areas. Soil development generally is about as far advanced on the steep parts of uplands as it is on the gently sloping or nearly level parts. Most of the depressions, however, are poorly drained, and the soils in them show characteristics related to wetness.

Time

All of the soils in this survey area developed in the relatively short time that has elapsed since the ice sheet that formerly covered part of the Homer-Ninilchik Area receded. Horizon differentiation is well advanced in most of the soils of the uplands, but wet soils show little profile development.

Classification of Soils

Soils are classified so that their significant characteristics can be more easily remembered. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole enviroment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply knowledge of soils to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland, in engineering works, and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 *(2)* and later revised *(10)*. The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. It is under continual study. Readers interested in developments of this system should refer to the latest literature available *(9, 12)*. In table 7, the soil series of the Homer-Ninilchik Area are placed in some categories of the current system and in the great soil groups of the older system.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system soil properties that are observable and measurable are used as a basis for classification. The properties are chosen so that the soils of similar genesis, or the way they formed, are grouped together. Except for soil series, the classes that make up the current system are briefly defined in the following paragraphs. Soil series is defined in the section "How This Survey Was Made."

ORDER: Ten soil orders are recognized in this system. They are Alfisols, Aridisols, Entisols, Histosols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, and Vertisols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. The exceptions are the Entisols, Inceptisols, and Histosols, which occur in many different climates. Four of the soil orders are represented in the Homer-Ninilchik Area. They are Entisols, Histosols, Inceptisols, and Spodosols.

Entisols are recent mineral soils that do not have genetic diagnostic horizons or have only the beginnings of such horizons. These soils have changed little from the geologic parent material in which they are developing.

Histosols are soils that formed from organic material. The Doroshin, Salamatof, and Starichkof soils are the Histosols in the Homer-Ninilchik Area.

Inceptisols are mineral soils in which horizons have started to develop but do not have an accumulation of illuvial clay or iron and aluminum oxides.

Spodosols are soils that have, at or near the surface, a horizon in which iron and aluminum oxides have accumulated, together with some organic carbon but with little or no additional clay.

SUBORDER: Each order is subdivided into suborders, primarily on the basis of those soil characteristics that seem to produce classes with greatest genetic similarities. The suborder narrows the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation.

GREAT GROUP: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus has accumulated, or those that have pans that interfere with the growth of roots or the movement of water. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The

TABLE 7.—*Soil series classified according to the current system of classification and the 1938 system with its later revisions*

Series	Current classification			1938 classification
	Family	Subgroup	Order	Great group
Anchor Point	Coarse-loamy over sand or sandy-skeletal, mixed, acid	Typic Cryaquepts	Inceptisols	Low-Humic Gley soils.
Beluga	Coarse-loamy, mixed, acid	Typic Cryaquepts	Inceptisols	Low-Humic Gley soils.
Bernice	Sandy-skeletal, mixed	Typic Cryorthods	Spodosols	Podzols.
Coal Creek	Coarse-silty, mixed, acid	Humic Cryaquepts	Inceptisols	Humic Gley soils.
Cohoe	Coarse-silty, mixed	Typic Cryorthods	Spodosols	Podzols.
Doroshin	Loamy, mixed, dysic	Terric Borohemists	Histosols	Bog soils.
Grewingk	Coarse-loamy, mixed	Sideric Cryaquods	Spodosols	Podzols intergrading toward Low-Humic Gley soils.
Island	Thixotropic	Dystric Cryandepts	Inceptisols	Ando soils.
Kachemak	Thixotropic over loamy, mixed	Dystric Cryandepts	Inceptisols	Ando soils.
Killey	Coarse-loamy over sand or sandy-skeletal, mixed, acid	Aeric Cryaquepts	Inceptisols	Low-Humic Gley soils.
Moose River	Coarse-loamy, mixed, acid	Typic Cryaquents	Entisols	Low-Humic Gley soils.
Mutnala	Thixotropic over loamy, mixed	Typic Cryorthods	Inceptisols	Podzols.
Nikolai	Loamy, mixed, dysic	Terric Borosaprists	Spodosols	Bog soils.
Salamatof	Dysic	Cryic Sphagnofibrists	Histosols	Bog soils.
Slikok	Coarse-silty, mixed, acid	Histic Cryaquepts	Inceptisols	Humic Gley soils.
Spenard	Fine-silty, mixed	Sideric Cryaquods	Spodosols	Podzols intergrading toward Low-Humic Gley soils.
Starichkof	Dysic	Typic Borohemists	Histosols	Bog soils.

great group is not shown in table 7 because it is the last word in the name of the subgroup.

SUBGROUP: Great groups are subdivided into subgroups, one that represents the central (typic) segment of the group and others, called intergrades, that have properties of another great group, suborder, or order. The names of the subgroups are derived by placing one or more adjective before the name of the great group.

The subgroups in this survey area, and shown in table 7, are Aeric Cryaquepts, Cryic Sphagnofibrists, Dystric Cryandepts, Histic Cryaquepts, Humic Cryaquepts, Sideric Cryaquods, Terric Borohemists, Terric Borosaprists, Typic Borohemists, Typic Cryaquents, Typic Cryaquepts, and Typic Cryorthods.

Aeric Cryaquepts have strong colors, but in other respects they have characteristics that are associated with wetness.

Cryic Sphagnofibrists are cold peat soils that consist mostly of fibrous remains of sphagnum moss.

Dystric Cryandepts are cold, acid soils that formed in material in which volcanic ash is dominant. These soils release water and become smeary when rubbed.

Histic Cryaquepts are cold, wet soils that have a fairly thick deposit of organic material on the surface, or they have mucky upper horizons.

Humic Cryaquepts are cold, wet soils that have a thick, dark-colored mineral horizon on the surface.

Sideric Cryaquods are cold Spondosols that are mottled or have other indications of wetness. They also have reddish illuvial horizons.

Terric Borohemists are peat soils that have a shallow mineral substratum. The peat is partly disintegrated.

Terric Borosaprists are mucky organic soils that have a shallow mineral substratum.

Typic Borohemists are cold peat soils that consist mainly of partly disintegrated organic material.

Typic Cryaquents are cold, wet soils that are sandy or that have greenish or bluish colors.

Typic Cryaquepts are cold soils that have dull colors and mottling, which are characteristics that are associated with wetness. These soils are saturated with water most of the summer unless they are artificially drained.

Typic Cryorthods are cold Spodosols that have only moderate amounts of organic matter in the illuvial horizon. These soils are well drained.

FAMILY: Families are separated within the subgroup primarily on the basis of properties important to growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. Table 7 gives the family of each of the series represented in the survey area, though some family designations may be changed as more information is obtained.

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Glossary

ABC soil. A soil that has a complete profile, including an A, B, and C horizon.

AC soil. A soil that has an A and a C horizon but no B horizon. Commonly such soils are immature, as those developing from alluvium or those on steep, rocky slopes.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity. The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide nutrients in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Glacial drift. Material transported by glacial ice and then deposited; also includes assorted and unassorted materials deposited by streams flowing from glaciers.

Glacial till. Unassorted, nonstratified glacial drift consisting of clay, silt, sand, gravel, and boulders transported and deposited by glacial ice.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and alumium oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Loam. Soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Loess. Material transported and deposited by wind; consisting dominantly of silt-sized particles.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Imperfectly or somewhat poorly drained soils are wet for significant periods but not all the time, and Podzolic soils commonly have mottlings in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Nutrient, plant. Any element that is taken in by a plant, is essential to its growth, and is used by the plant in producing food and tissue. Important plant nutrients obtained from the soil are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and other elements. Those obtained from the air and water are carbon, hydrogen, and oxygen.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permafrost. Layers of soil in which the temperatures permanently are at or below 0° C., whether consistence is very hard or loose (dry permafrost).

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Poorly graded. A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degree of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Runoff. The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water

that flows off the land surface without sinking in is called surface runoff; that which enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which it belongs. To learn about the management of a capability unit, read the description of the unit and also the introduction to the section in which the unit is described. Other information is given in tables as follows:

Acreage and extent, table 3, p. 8.

Engineering uses of soils, tables 4, 5, and 6, pp. 36 through 43.

Map symbol	Mapping unit	Described on page	Management Group (Capability unit) Number	Page
Ad	Alluvial land	7	23(VIIIw-1)	30
Ap	Anchor Point and Killey silt loams	9	11(IVw-1)	29
BaA	Beluga silt loam, nearly level	10	8(IIIw-2)	29
BaB	Beluga silt loam, gently sloping	10	3(IIw-1)	28
BaC	Beluga silt loam, moderately sloping	10	9(IIIw-3)	29
BaD	Beluga silt loam, strongly sloping	10	12(IVw-2)	29
BeE	Bernice sandy loam, strongly sloping to steep	12	19(VIIe-2)	30
CkA	Coal Creek silt loam, nearly level	12	13(IVw-3)	29
CkB	Coal Creek silt loam, gently sloping	12	13(IVw-3)	29
CkC	Coal Creek silt loam, moderately sloping	12	9(IIIw-3)	29
CkD	Coal Creek silt loam, strongly sloping	12	12(IVw-2)	29
CoA	Cohoe silt loam, nearly level	13	2(IIc-1)	28
CoB	Cohoe silt loam, gently sloping	13	1(IIe-1)	28
CoC	Cohoe silt loam, moderately sloping	13	4(IIIe-1)	28
CoD	Cohoe silt loam, strongly sloping	14	10(IVe-1)	29
CoE	Cohoe silt loam, moderately steep	14	14(VIe-1)	30
CoF	Cohoe silt loam, steep	14	18(VIIe-1)	30
DoA	Doroshin peat, nearly level	14	21(VIIw-2)	30
DoB	Doroshin peat, gently sloping	14	21(VIIw-2)	30
DoC	Doroshin peat, moderately sloping	15	21(VIIw-2)	30
Gb	Gravelly beach	15	23(VIIIw-1)	30
GrE	Grewingk fine sandy loam, strongly sloping to steep	15	20(VIIw-1)	30
IaA	Island silt loam, nearly level	16	2(IIc-1)	28
IaB	Island silt loam, gently sloping	17	1(IIe-1)	28
IaC	Island silt loam, moderately sloping	17	4(IIIe-1)	28
IaD	Island silt loam, strongly sloping	17	10(IVe-1)	29
IaE	Island silt loam, moderately steep	17	14(VIe-1)	30
KhA	Kachemak silt loam, nearly level	18	15(VIc-1)	30
KhB	Kachemak silt loam, gently sloping	18	5(IIIe-2)	28
KhC	Kachemak silt loam, moderately sloping	19	5(IIIe-2)	28
KhD	Kachemak silt loam, strongly sloping	19	10(IVe-1)	29
KhE	Kachemak silt loam, moderately steep	19	14(VIe-1)	30
KhF	Kachemak silt loam, steep	19	18(VIIe-1)	30
Mo	Moose River silt loam	20	16(VIw-1)	30
MuA	Mutnala silt loam, nearly level	21	6(IIIs-1)	29
MuB	Mutnala silt loam, gently sloping	21	4(IIIe-1)	28
MuC	Mutnala silt loam, moderately sloping	21	4(IIIe-1)	28
MuD	Mutnala silt loam, strongly sloping	21	10(IVe-1)	29
MuE	Mutnala silt loam, moderately steep	22	14(VIe-1)	30
MuF	Mutnala silt loam, steep	22	18(VIIe-1)	30
Nl	Nikolai silt loam	23	7(IIIw-1)	29
Ro	Rough broken land	23	22(VIIIs-1)	30
Sa	Salamatof peat	23	21(VIIw-2)	30
SkA	Slikok mucky silt loam, nearly level	24	13(IVw-3)	29
SkB	Slikok mucky silt loam, gently sloping	24	13(IVw-3)	29
SpA	Spenard silt loam, nearly level	24	13(IVw-3)	29
SpB	Spenard silt loam, gently sloping	25	13(IVw-3)	29
SpC	Spenard silt loam, moderately sloping	25	9(IIIw-3)	29
SrA	Starichkof peat, nearly level	25	21(VIIw-2)	30
SrB	Starichkof peat, gently sloping	25	21(VIIw-2)	30
Ta	Tidal flats	25	23(VIIIw-1)	30
Tm	Tidal marsh	25	17(VIw-2)	30

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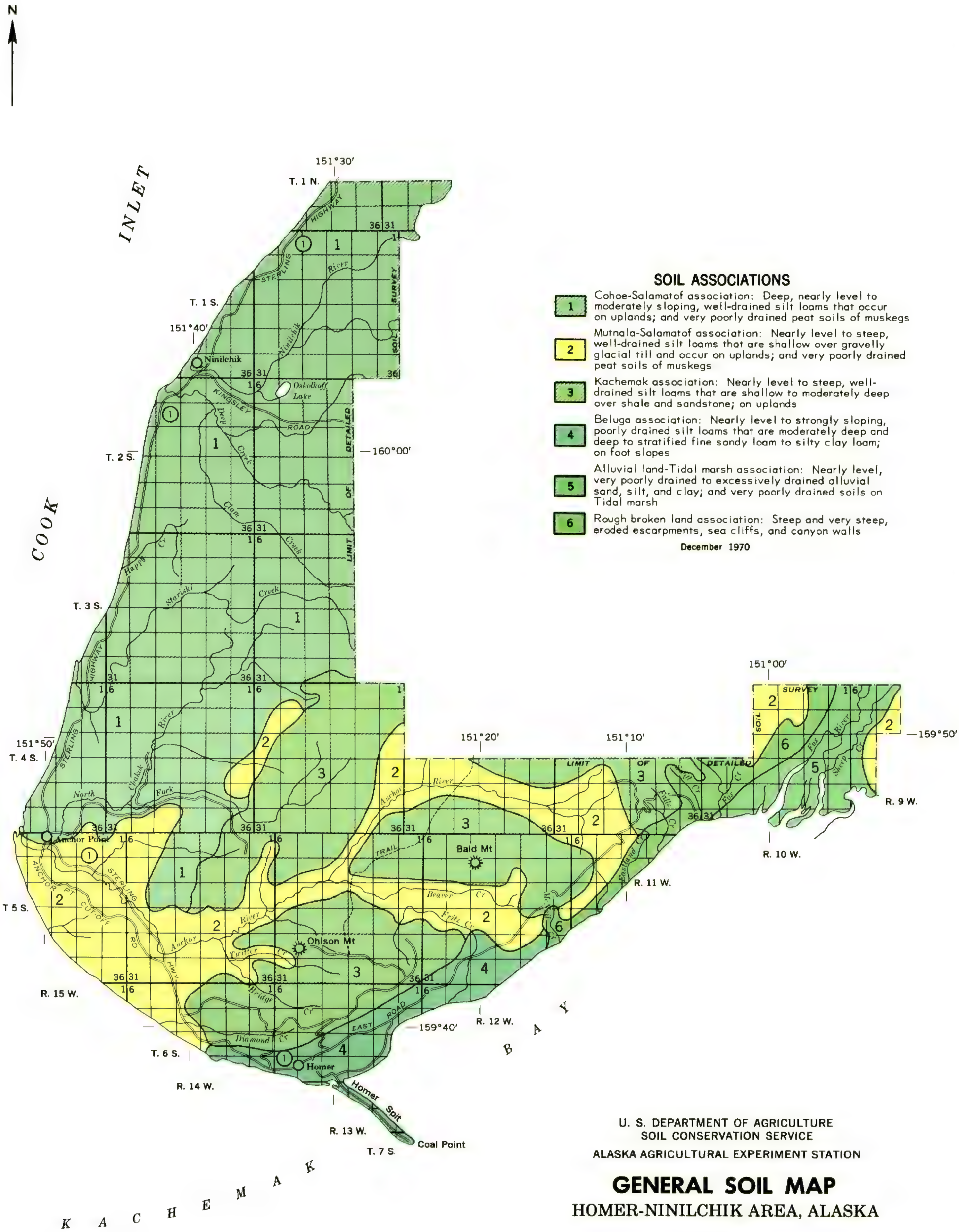


SOIL ASSOCIATIONS

1 — Cohoe-Salamatof association: Deep, nearly level to moderately sloping, well-drained silt loams that occur on uplands; and very poorly drained peat soils of muskegs

2 — Mutnala-Salamatof association: Nearly level to steep, well-drained silt loams that are shallow over gravelly glacial till and occur on uplands; and very poorly drained peat soils of muskegs

3 — Kachemak association: Nearly level to steep, well-drained silt loams that are shallow to moderately deep over shale and sandstone; on uplands

4 — Beluga association: Nearly level to strongly sloping, poorly drained silt loams that are moderately deep and deep to stratified fine sandy loam to silty clay loam; on foot slopes

5 — Alluvial land-Tidal marsh association: Nearly level, very poorly drained to excessively drained alluvial sand, silt, and clay; and very poorly drained soils on Tidal marsh

6 — Rough broken land association: Steep and very steep, eroded escarpments, sea cliffs, and canyon walls

December 1970

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALASKA AGRICULTURAL EXPERIMENT STATION

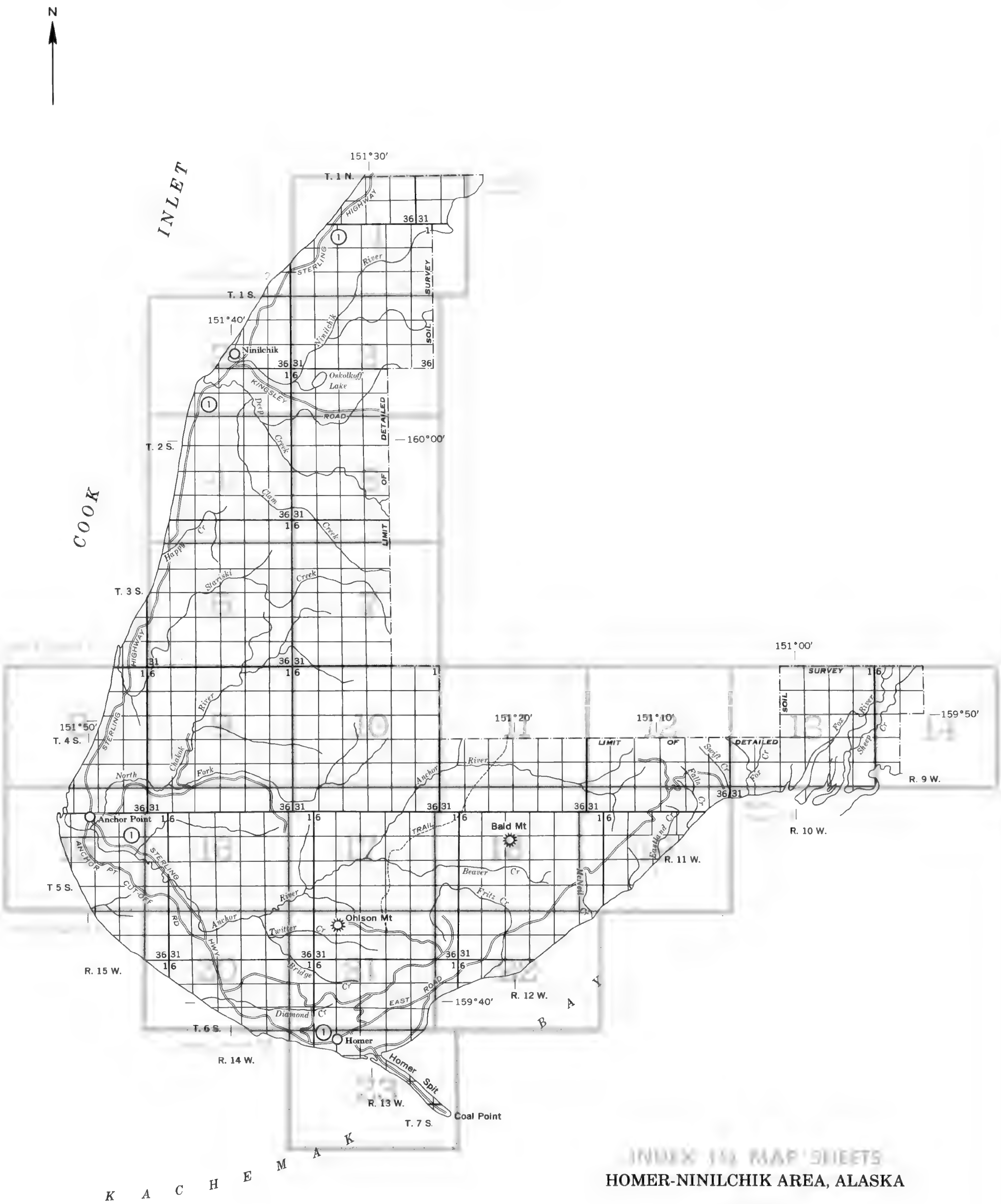
GENERAL SOIL MAP

HOMER-NINILCHIK AREA, ALASKA

Scale 1:253,440

1 0 1 2 3 4 Miles

NOTE—
This map is intended for general planning. Each delineation may contain soils having ratings different from those shown on the map. Use detailed soil maps for operational planning.



INDEX TO MAP SHEETS
HOMER-NINILCHIK AREA, ALASKA

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of nearly level soils or land types, but some are for land types that have a considerable range of slope.

SYMBOL	NAME
Ad	Alluvial land
Ap	Anchor Point and Killey silt loams
BaA	Beluga silt loam, nearly level
BaB	Beluga silt loam, gently sloping
BaC	Beluga silt loam, moderately sloping
BaD	Beluga silt loam, strongly sloping
BeE	Bernice sandy loam, strongly sloping to steep
CkA	Coal Creek silt loam, nearly level
CkB	Coal Creek silt loam, gently sloping
CkC	Coal Creek silt loam, moderately sloping
CkD	Coal Creek silt loam, strongly sloping
CoA	Cohoe silt loam, nearly level
CoB	Cohoe silt loam, gently sloping
CoC	Cohoe silt loam, moderately sloping
CoD	Cohoe silt loam, strongly sloping
CoE	Cohoe silt loam, moderately steep
CoF	Cohoe silt loam, steep
DoA	Doroshin peat, nearly level
DoB	Doroshin peat, gently sloping
DoC	Doroshin peat, moderately sloping
Gb	Gravelly beach
GrE	Grewingk fine sandy loam, strongly sloping to steep
IaA	Island silt loam, nearly level
IaB	Island silt loam, gently sloping
IaC	Island silt loam, moderately sloping
IaD	Island silt loam, strongly sloping
IaE	Island silt loam, moderately steep
KhA	Kachemak silt loam, nearly level
KhB	Kachemak silt loam, gently sloping
KhC	Kachemak silt loam, moderately sloping
KhD	Kachemak silt loam, strongly sloping
KhE	Kachemak silt loam, moderately steep
KhF	Kachemak silt loam, steep
Mo	Moose River silt loam
MuA	Mutnala silt loam, nearly level
MuB	Mutnala silt loam, gently sloping
MuC	Mutnala silt loam, moderately sloping
MuD	Mutnala silt loam, strongly sloping
MuE	Mutnala silt loam, moderately steep
MuF	Mutnala silt loam, steep
Nl	Nikolai silt loam
Ro	Rough broken land
Sa	Salamatof peat
SkA	Slikok mucky silt loam, nearly level
SkB	Slikok mucky silt loam, gently sloping
SpA	Spenard silt loam, nearly level
SpB	Spenard silt loam, gently sloping
SpC	Spenard silt loam, moderately sloping
SrA	Starichkof peat, nearly level
SrB	Starichkof peat, gently sloping
Ta	Tidal flats
Tm	Tidal marsh

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Sawmill

BOUNDARIES

- National or state
- County
- Project area
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches (CANAL)

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

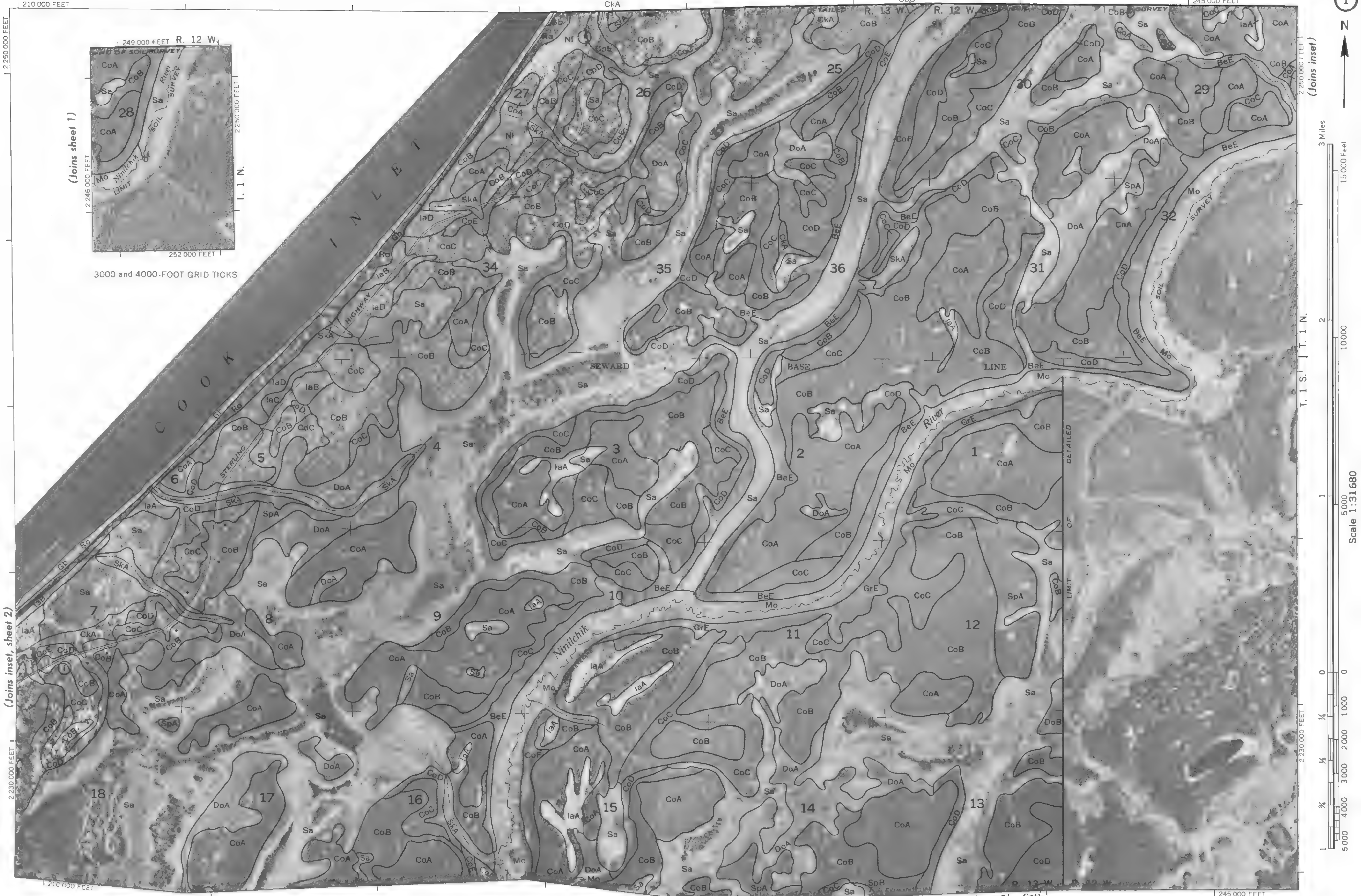
RELIEF

- Escarpment, unclassified

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

HOMER-NINILCHIK AREA, ALASKA — SHEET NUMBER 1



This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Alaska Agricultural Experiment Station.

Land division corners are approximately positioned on this map.

HOMER-NINILCHIK AREA, ALASKA NO. 1

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4. 1927 North American datum.

HOMER-NINILCHIK AREA, ALASKA — SHEET NUMBER 2

HOMER-NINILCHIK AREA, ALASKA NO. 2

Land division corners are approximately positioned on this map.

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Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4. 1927 North American datum.

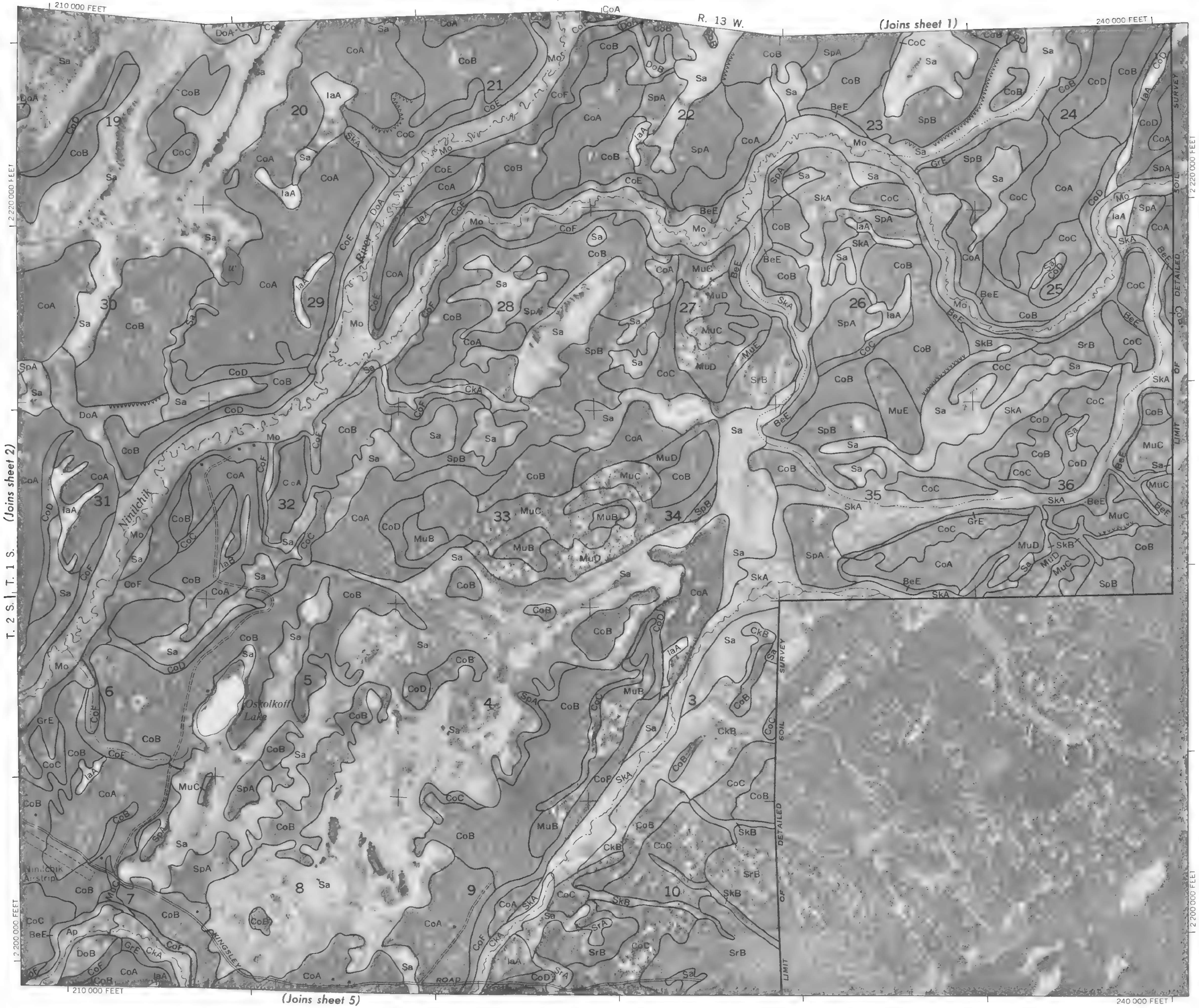
HOMER - NINILCHIK AREA, ALASKA — SHEET NUMBER 3

3

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Alaska Agricultural Experiment Station.

Land division corners are approximately positioned on this map.

HOMER-NINILCHIK AREA, ALASKA NO. 3



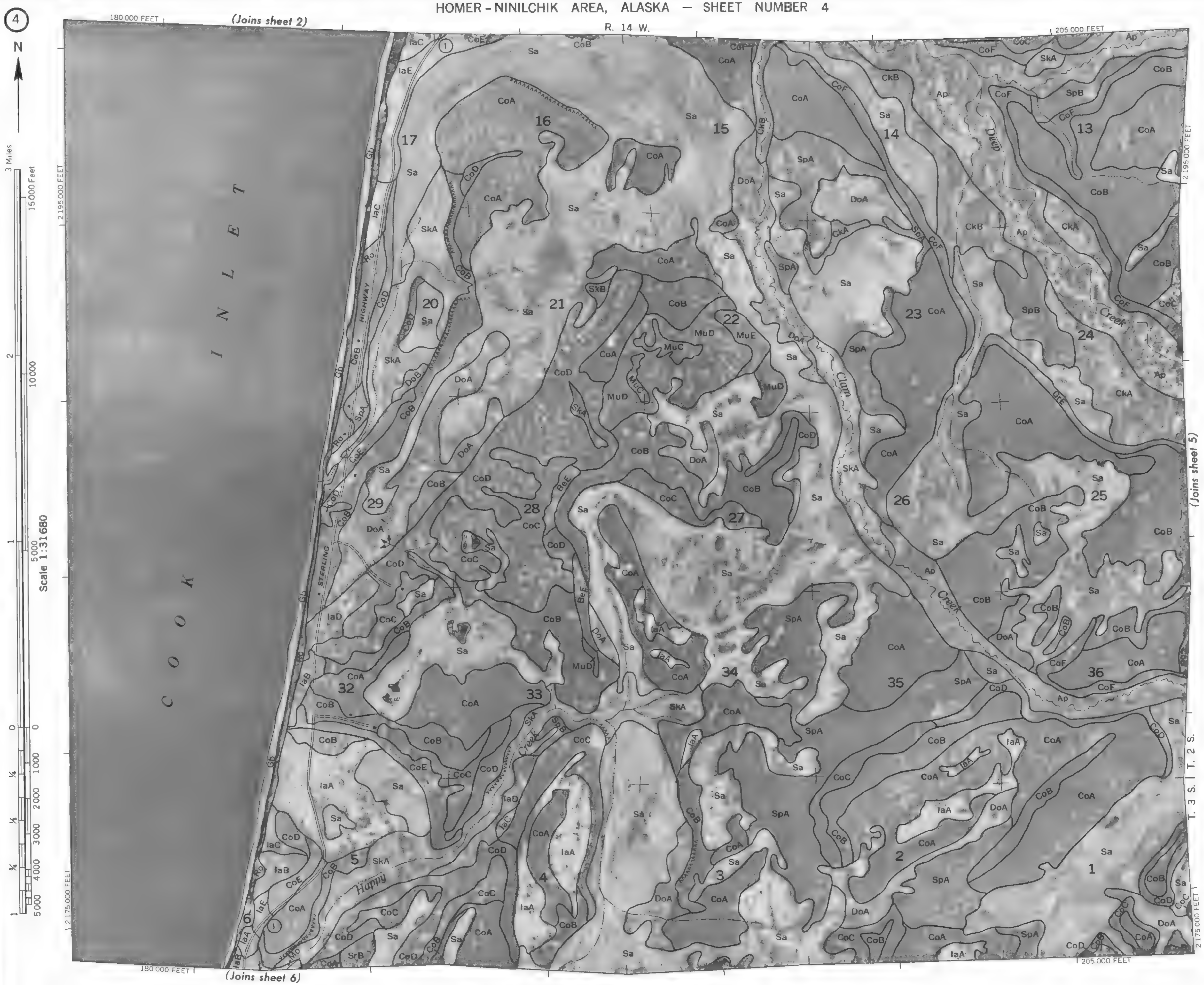
N

Scale 1:31 680

3 Miles
2
1
0
15 000 Feet
10000
5000
0
1000
2000
3000
4000
5000

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4, 1927 North American datum.

HOMER-NINILCHIK AREA, ALASKA — SHEET NUMBER 4



HOMER-NINILCHIK AREA, ALASKA NO. 4

Land division corners are approximately positioned on this map.

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HOMER-NINILCHIK AREA, ALASKA — SHEET NUMBER 5

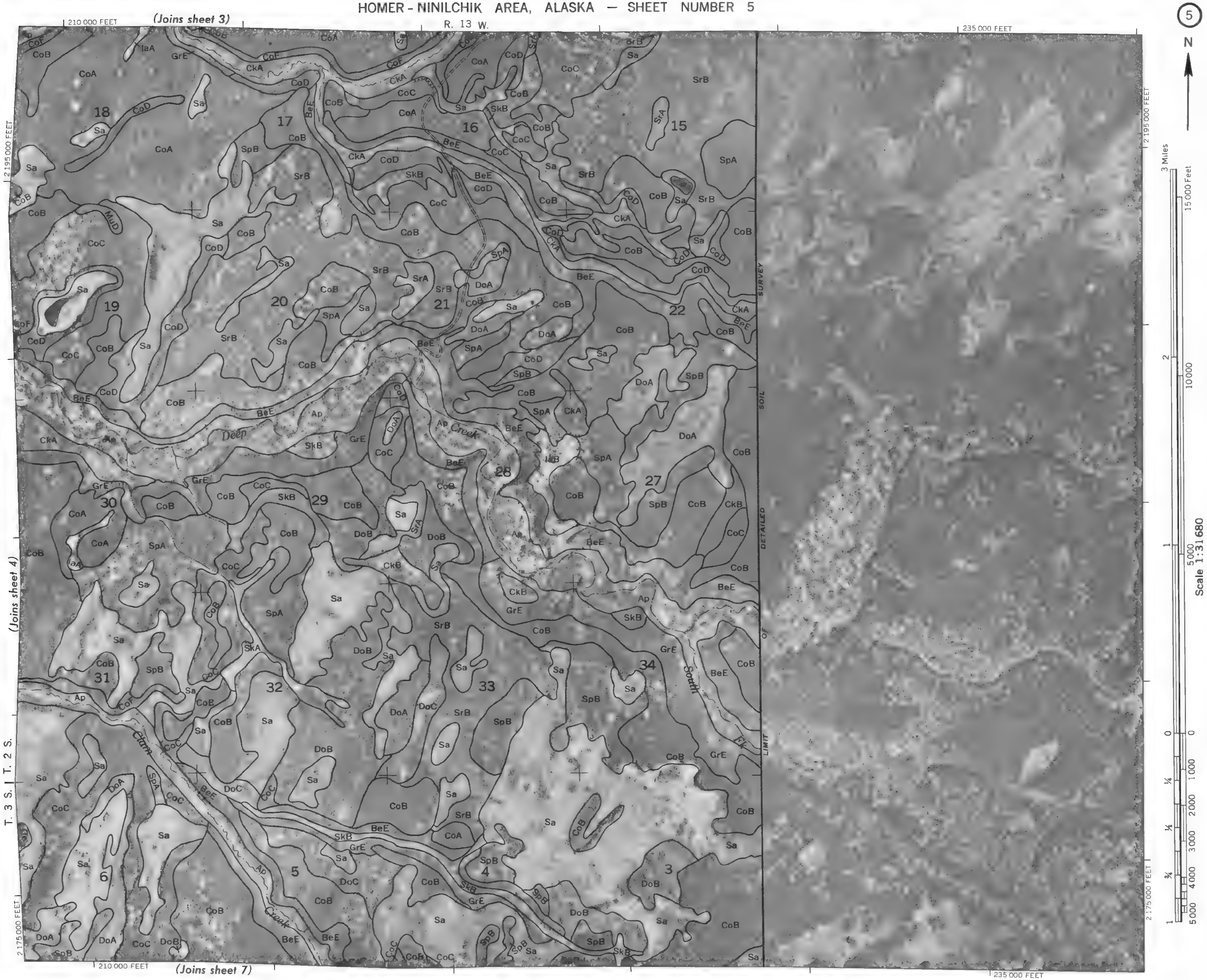

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4. 1927 North American datum.

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HOMER-NINILCHIK AREA, ALASKA NO. 5

HOMER-NINILCHIK AREA, ALASKA NO. 6

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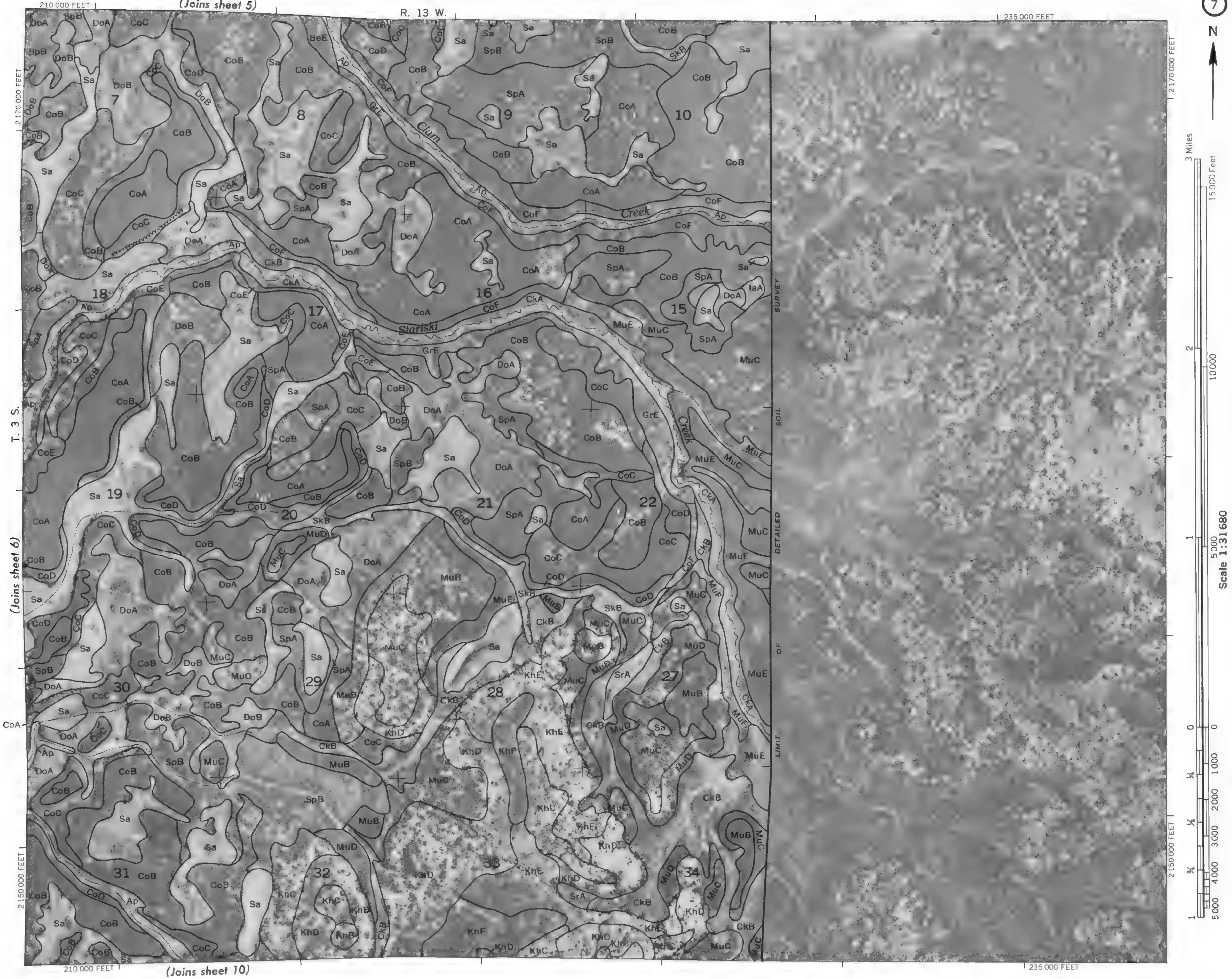
HOMER - NINILCHIK AREA, ALASKA — SHEET NUMBER 7



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Land division corners are approximately positioned on this map.

HOMER-NINILCHIK AREA, ALASKA NO. 7

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4, 1927 North American datum.

HOMER-NINILCHIK AREA, ALASKA NO. 8

Land division corners are approximately positioned on this map.

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HOMER - NINILCHIK AREA, ALASKA — SHEET NUMBER 9

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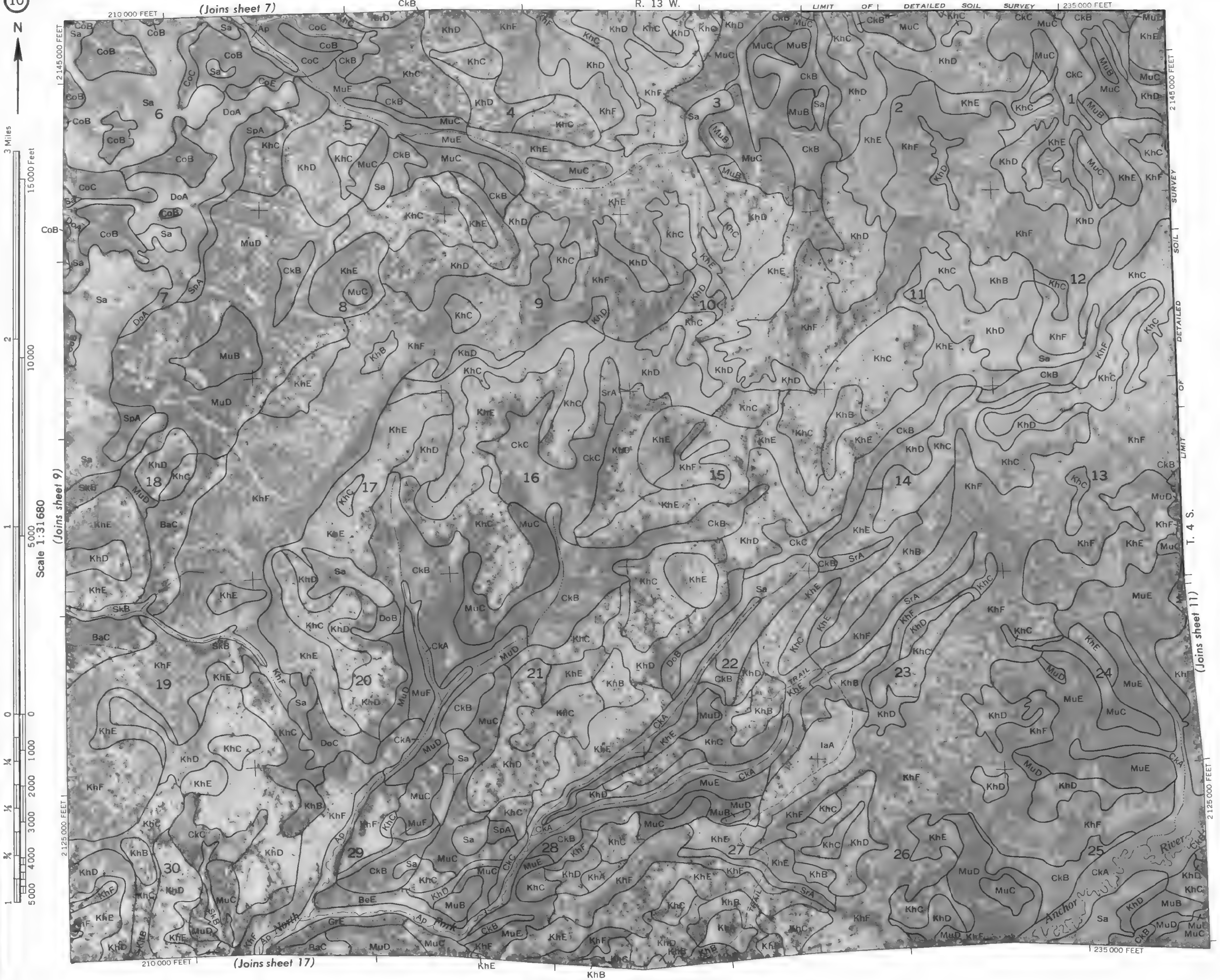
Land division corners are approximately positioned on this map.

HOMER-NINILCHIK AREA, ALASKA NO. 9

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4. 1927 North American datum.

HOMER - NINILCHIK AREA, ALASKA — SHEET NUMBER 10



HOMER-NINILCHIK AREA, ALASKA NO. 10

Land division corners are approximately positioned on this map.

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HOMER-NINILCHIK AREA, ALASKA NO. 11

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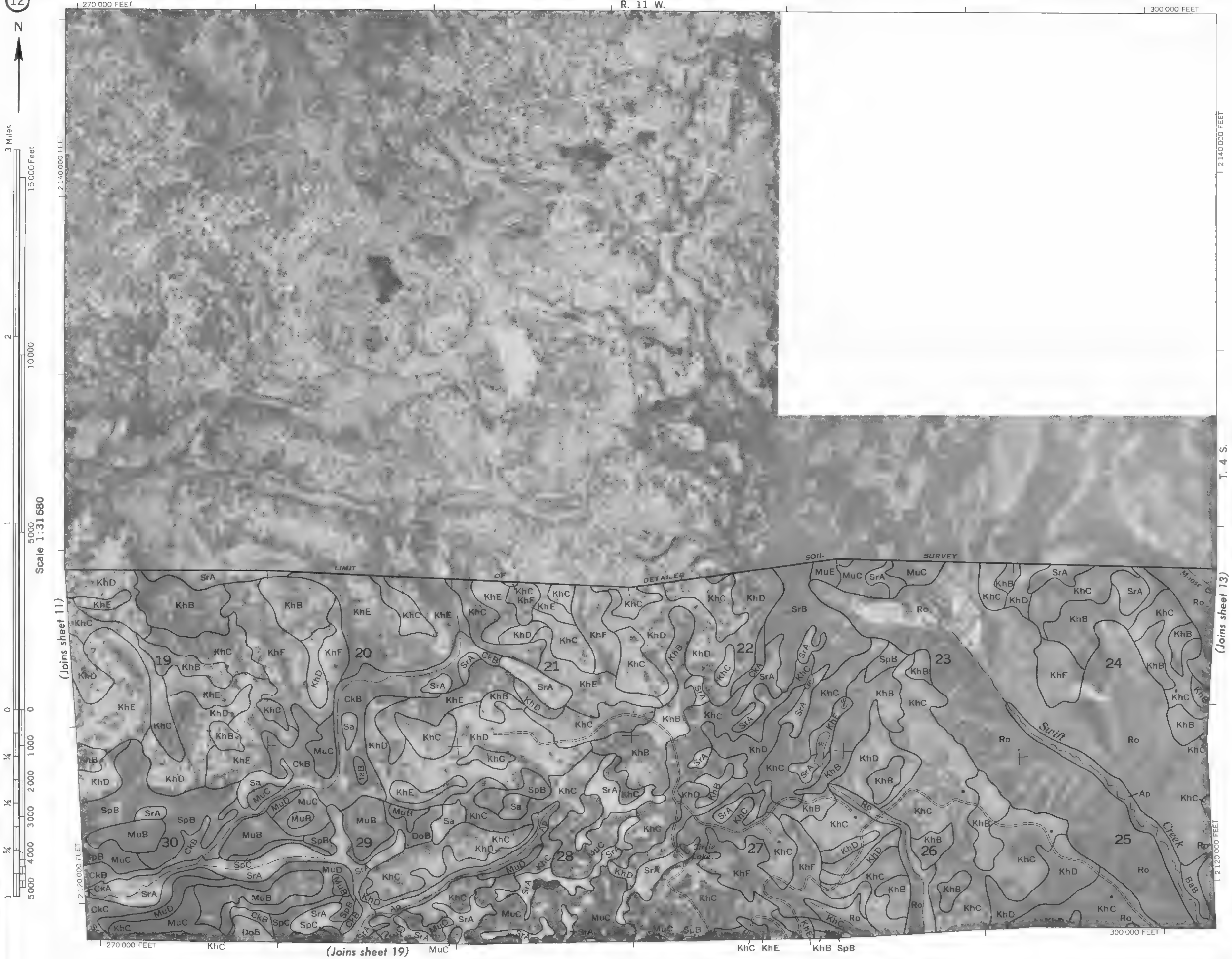
HOMER - NINILCHIK AREA, ALASKA — SHEET NUMBER 12



HOMER-NINILCHIK AREA, ALASKA NO. 12

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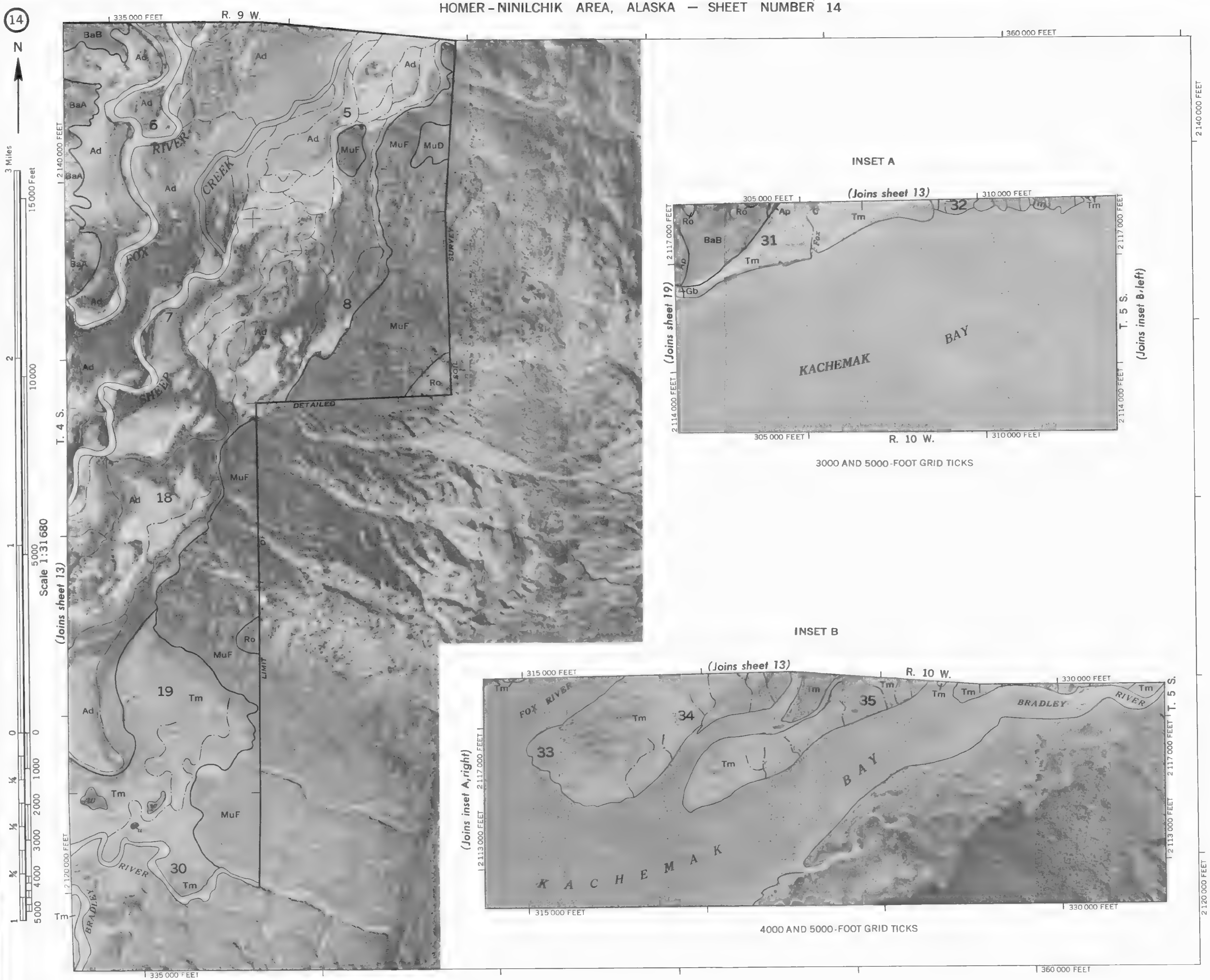
Land division corners are approximately positioned on this map.

HOMER-NINILCHIK AREA, ALASKA NO. 13

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4, 1927 North American datum.

HOMER-NINILCHIK AREA, ALASKA — SHEET NUMBER 14



HOMER-NINILCHIK AREA, ALASKA NO. 14

Land division corners are approximately positioned on this map.

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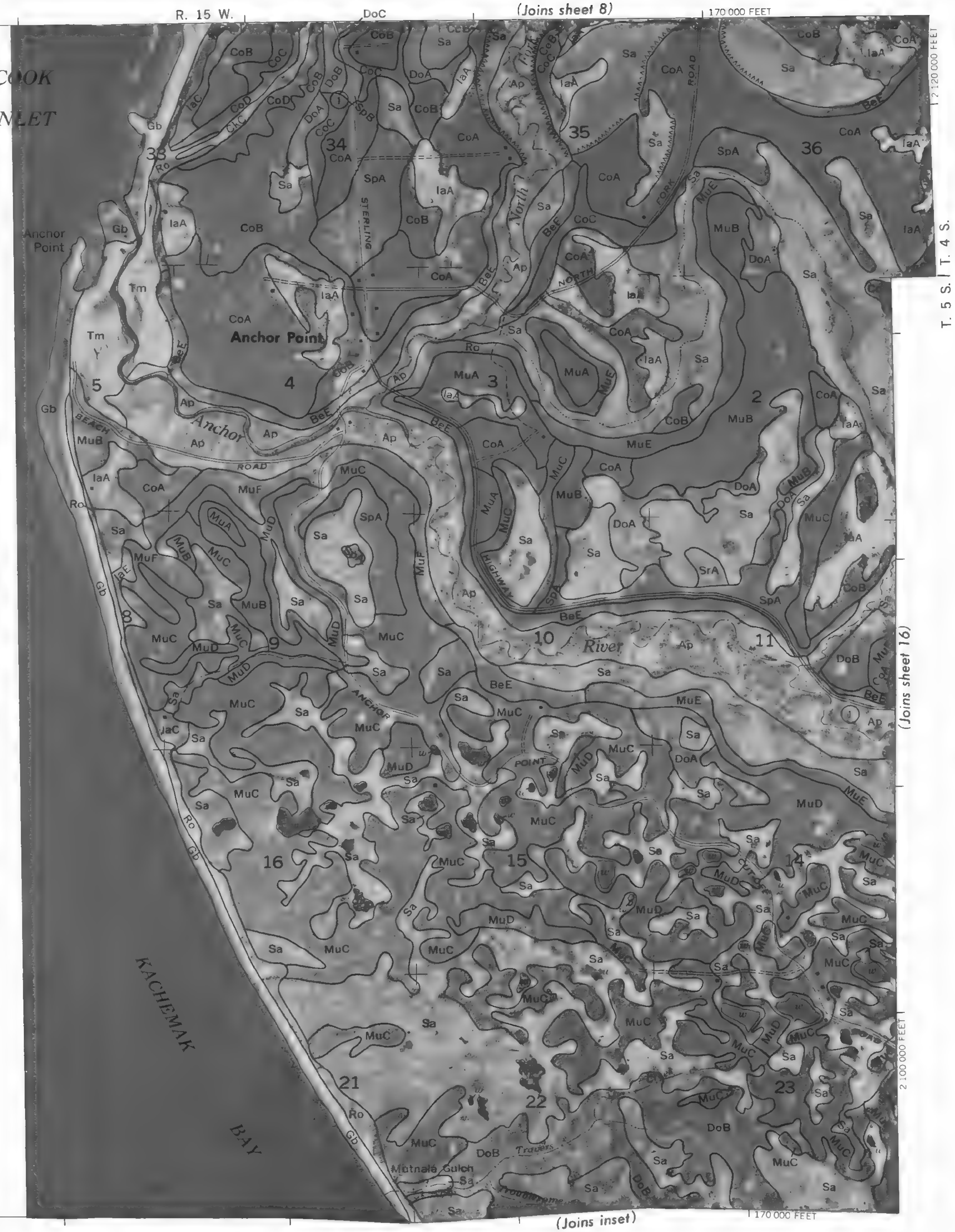
Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4. 1927 North American datum.

N

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Alaska Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

HOMER-NINILCHIK AREA, ALASKA NO. 15



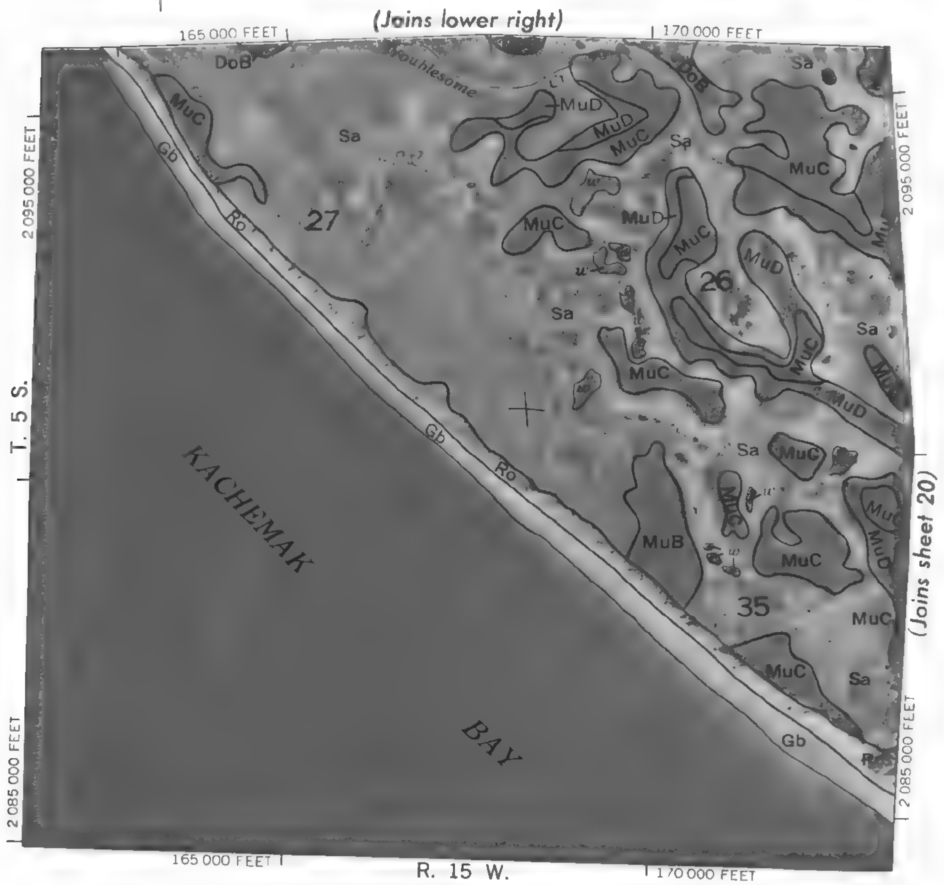


Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4-1927 North American datum.

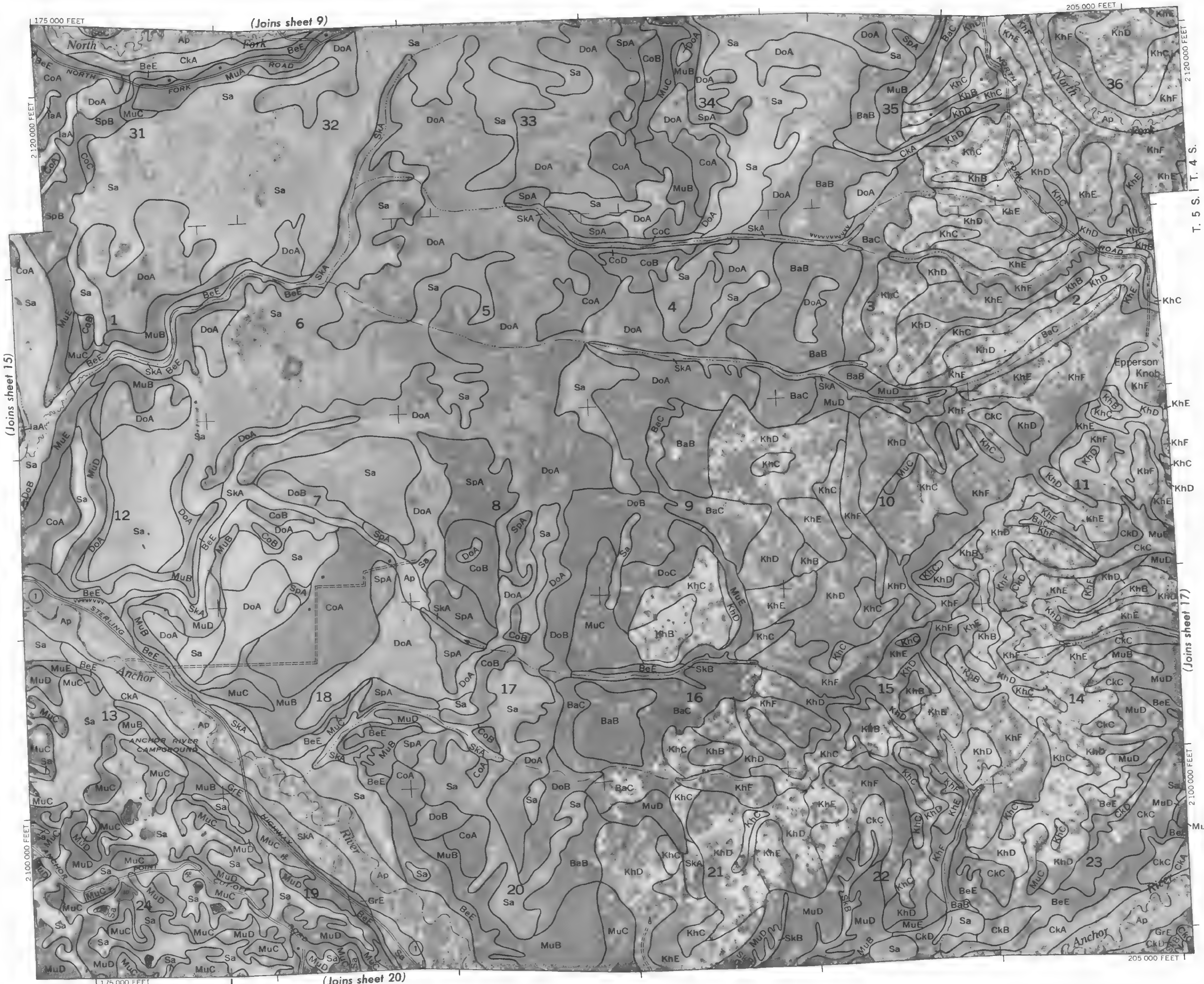
3 Miles

15 000 Feet

Scale 1:31680

16

N



Scale 1:31 680

3 Miles | 2 | 1 | 0 | 1/4 | 1/2 | 3/4 | 1

15 000 Feet | 10000 | 5000 | 0 | 1000 | 2000 | 3000 | 4000 | 5000

HOMER-NINILCHIK AREA, ALASKA NO. 16

Land division corners are approximately positioned on this map.

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Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4, 1927 North American datum.

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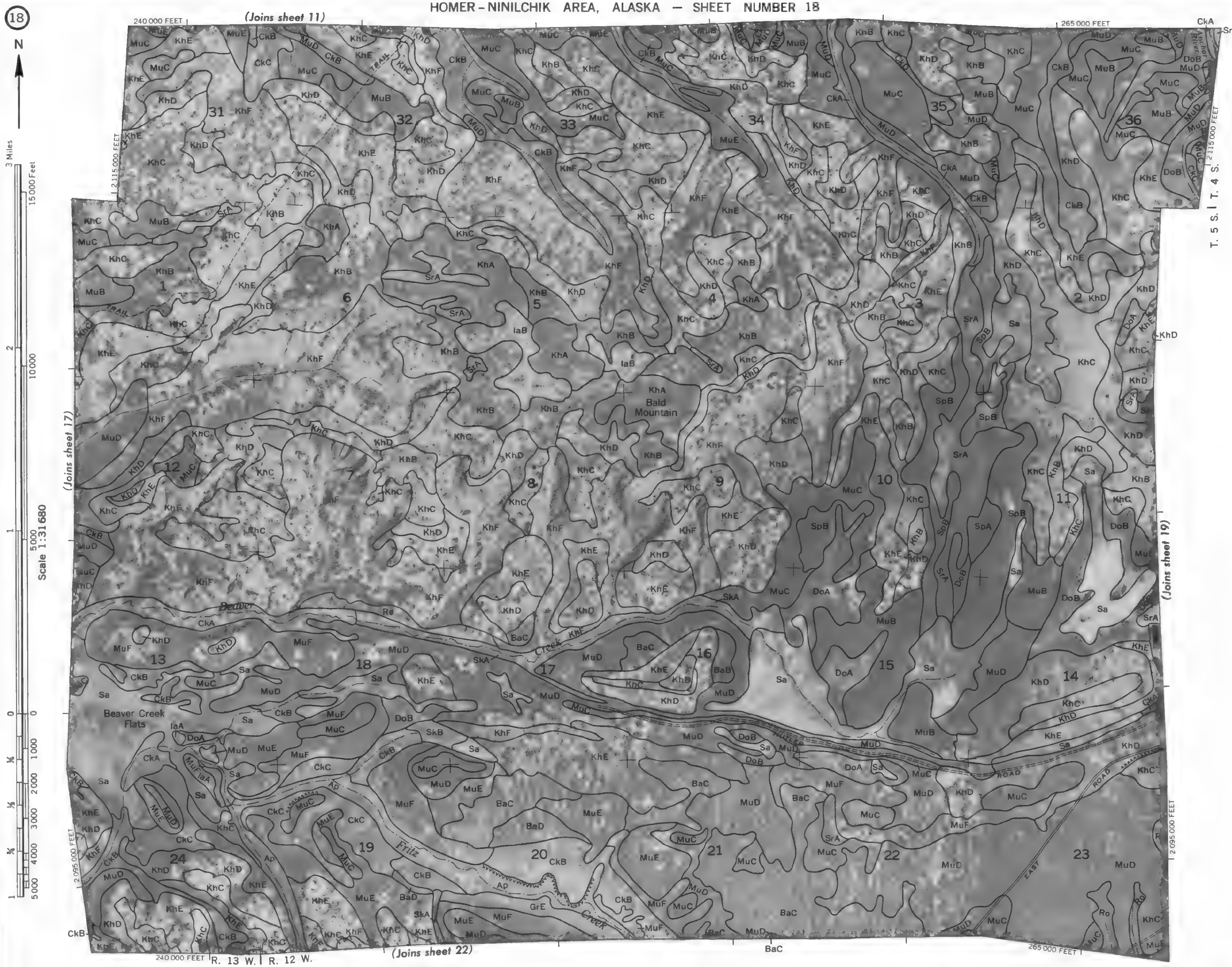
Land division corners are approximately positioned on this map.

HOMER-NINILCHIK AREA, ALASKA NO. 17

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4, 1927 North American datum.

HOMER-NINILCHIK AREA, ALASKA — SHEET NUMBER 18

18



HOMER-NINILCHIK AREA, ALASKA NO. 18

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Alaska Agricultural Experiment Station.

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4. 1927 North American datum.

HOMER - NINILCHIK AREA, ALASKA — SHEET NUMBER 19

(19)

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Alaska Agricultural Experiment Station.

Land division corners are approximately positioned on this map.

HOMER-NINILCHIK AREA, ALASKA NO. 19

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4, 1927 North American datum.

HOMER - NINILCHIK AREA, ALASKA — SHEET NUMBER 20

R. 15 W. | R. 14 W.

MuD (Joins sheet 16)

N

(Joins inset, sheet 15)

(Joins sheet 21)

(Joins inset, sheet 23)

T. 5 S. | T. 6 S.

Scale 1:31 680

3 Miles, 2, 1, 0, ¾, ½, ¼, 1

15 000 Feet, 10000, 5000, 0, 1000, 2000, 3000, 4000, 5000

HOMER-NINILCHIK AREA, ALASKA NO. 20

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Alaska Agricultural Experiment Station.

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4 1927 North American datum.

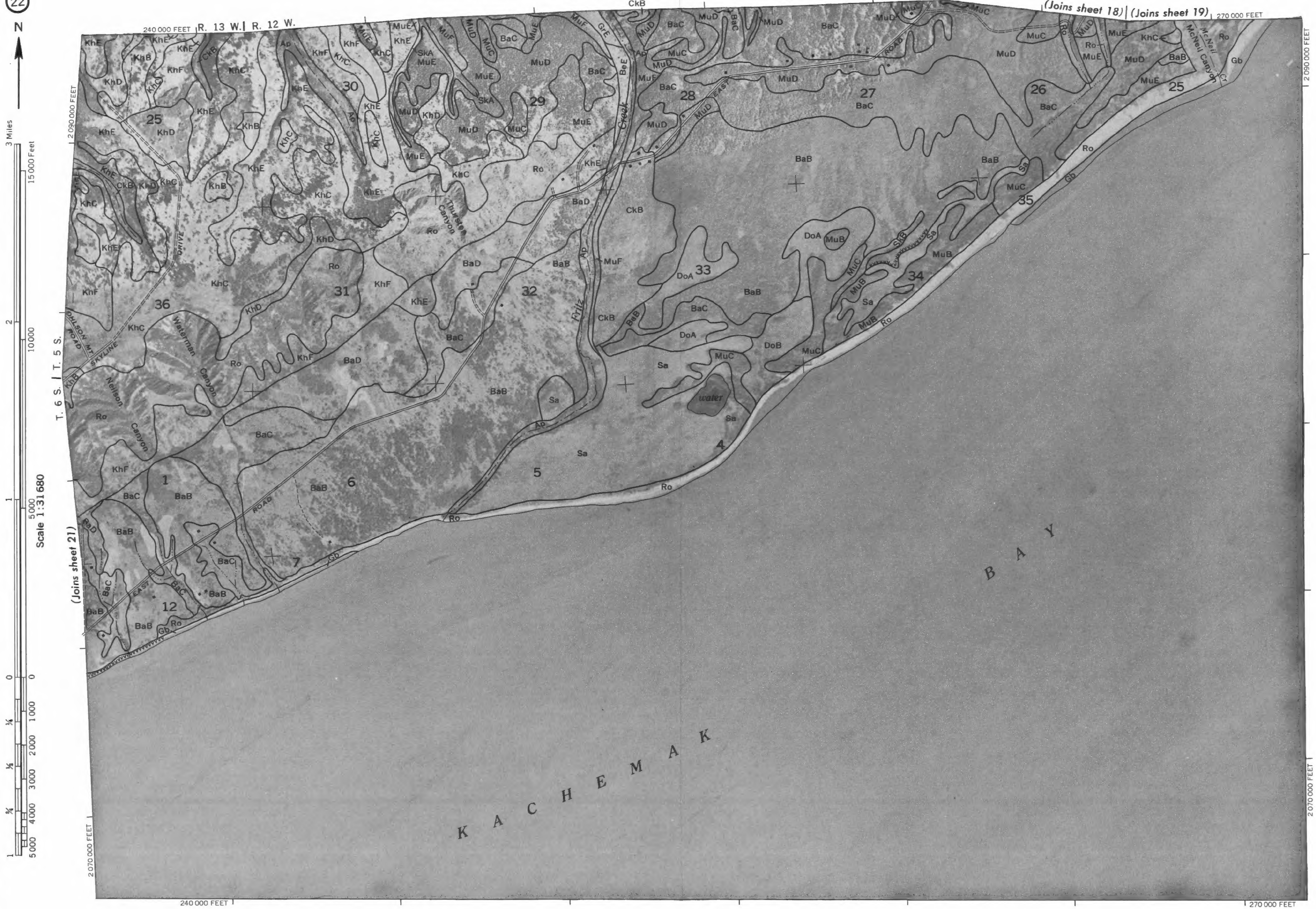
HOMER - NINILCHIK AREA, ALASKA — SHEET NUMBER 21

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Alaska Agricultural Experiment Station.
Land division corners are approximately positioned on this map.

HOMER-NINILCHIK AREA, ALASKA NO. 21

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4. 1927 North American datum.

HOMER-NINILCHIK AREA, ALASKA — SHEET NUMBER 22



HOMER-NINILCHIK AREA, ALASKA NO. 22

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Alaska Agricultural Experiment Station.

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4. 1927 North American datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Alaska Agricultural Experiment Station.

Land division corners are approximately positioned on this map.

HOMER-NINILCHIK AREA, ALASKA NO. 23

Photo base from 1951 aerial photographs. 5,000-foot grid ticks based on Alaska plane coordinate system, zone 4. 1927 North American datum.